THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

VOL. XXX. No. 762.] LONDON, DECEMBER 18, 1877. [29TH YEAR.] Price 6d.

ESTABLISHED 1782.

GAS-WORKS

ERECTED BY

WILLIAM BLEWS & SONS,

BIRMINGHAM: 9 to 15, New Bartholomew Street.
WEST BROMWICH: Royal Eagle Tube-Works.
MOSCOW: Dom Moltshanoff.

MANUFACTURERS OF
IRON GAS TUBES AND FITTINGS,
CHANDELIERS, & ALL ARTICLES REQUIRED
FOR GAS OR GAS-WORKS.

Reference to upwards of 200 Gas-Works erected or supplied with Materials by
WILLIAM BLEWS & SONS.

GENUINE TORBAY PAINT
AND
SPECIAL GASOMETER PAINT.
FOUR PRIZE MEDALS. ESTABLISHED OVER 20 YEARS.

These Paints are now used in 150 Country Gas-Works, and by all the London Gas Companies, on Gasholders, Scrubbers, Purifiers, &c. They will cover tar effectually. Also used by the Admiralty, War Office, Railway Companies, Founders, &c.

They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations.

The covering powers are considerably greater than those of any other Paint.—*See "Engineer," Nov. 2, 1866.*

STEVENS & CO.,
(SUCCESSORS TO SAMUEL CALLEY.)
21, GT. WINCHESTER ST., LONDON.
WORKS: BRIXHAM, TORBAY.

THOMAS PROUD,
BROOKFIELD GAS APPARATUS WORKS,
103, ICKNIELD STREET EAST, BIRMINGHAM.

SPECIALITÉS:
THE MANUFACTURE OF
IMPROVED DOUBLE-ACTION
SCRUBBERS
AND
WOOD GRIDS
FOR SAME.
Also WOOD GRIDS for PURIFIERS.

COWEN'S PATENT FIRE-CLAY RETORTS.
JOSEPH COWEN and CO.,
BLAYDON BURN, BLAYDON-ON-TYNE,

Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS-RETORTS and OTHER OBJECTS in FIRE-CLAY," and they were also awarded at the INTERNATIONAL EXHIBITION of 1862, the PRIZE MEDAL for "GAS-RETORTS, FIRE-BRICKS, &c., for EXCELLENCE of QUALITY."

J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts and Fire-Bricks in the Kingdom. Orders for Fire-Clay Retorts of all shapes and dimensions, and to fit any shaped Mouthpiece, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.

COWEN'S GARESFIELD COALS.

JOS. COWEN & CO. are the only Manufacturers of FIRE-BRICKS and CLAY RETORTS at BLAYDON BURN.

JOHN RUSSELL AND CO.,
LIMITED,
Established at the commencement of Gas Lighting.
BRANCH ESTABLISHMENTS:
48, GREEK STREET, SOHO SQUARE; 83, COMMERCIAL ST., SPITALFIELDS; } LONDON.
35, 36, 37, & 39, GRANBY ROW, MANCHESTER.
16, ELLIS COURT, AIRE STREET, LEEDS.
MANUFACTORIES: ALMA TUBE WORKS, WALSALL, AND OLD PATENT TUBE WORKS, WEDNESBURY.

J. R. & Co., Ld., are the original manufacturers of Wrought-Iron Gas Tubes and Fittings, and Inventors of the LAP-WELDED TUBES for Locomotive and Marine Boilers.

J. R. & Co., Ld., make all kinds of Tubes and Fittings for Gas, Steam, and Water; Gun-Metal Cocks, Stocks, and Dies; Galvanized Tubes and High-Pressure Tubes, &c.

Lists may be obtained on application to
HEAD LONDON OFFICE:
145, QUEEN VICTORIA STREET.
HEAD LONDON WAREHOUSE:
234, UPPER THAMES STREET, LONDON, E.C.

JOHN BENT & SON,
BELL BARN ROAD, BIRMINGHAM,
MANUFACTURERS OF
WET AND DRY GAS-METERS,
LICENSEES AND MANUFACTURERS OF
HUNT'S
PATENT COMPENSATING METERS,
STREET-LAMPS, &c., &c.

ESTABLISHED 1830.

THOMAS PIGGOTT & CO.,
SPRING HILL, BIRMINGHAM,
MANUFACTURERS OF
TELESCOPIC & SINGLE GASHOLDERS,
CAST & WROUGHT IRON TANKS FOR DITTO,
And Gas Apparatus of every Description.
Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.
SUGAR, SALTPETRE, AND ALL KINDS OF PANS.
Roofs, Girders, and Bridges, and General Smith's Work.
LONDON AGENT—W. G. DAVIS, 2, Brabant Court, Philpot Lane, E.C.

J. & H. ROBUS,
BUILDERS AND CONTRACTORS
FOR THE
ERECTION AND REBUILDING OF GAS AND WATER WORKS.
ESTIMATES FREE
FOR MAIN-LAYING AND GENERAL REPAIRS.

RETORT-SETTING A SPÉCIALITÉ.

ROBUS'S IMPROVED RETORT-SETTINGS guaranteed to carbonize a large amount of coal with a small per cent. of fuel.

N.B.—All kinds of Fire Goods, &c., kept in stock for immediate delivery. Orders promptly attended to.

BELL GREEN, CATFORD, S.E.

THE
NITSHILL COMPANY'S
DUKE OF HAMILTON'S
LESMAHAGOW
CANNEL COAL.

AGENT:
JAMES M'KELVIE,
HAYMARKET,
EDINBURGH.

GEORGE GLOVER & CO.

PATENTEES OF THE

NATIONAL STANDARD GASOMETERS

FOR THE ENGLISH GOVERNMENT
AND FOR THE GOVERNMENT OF THE NETHERLANDS
AND OF THE DUPLICATE COPY
Presented by Her Majesty's Government to the French Government,
AND MANUFACTURERS OF

IMPROVED DRY GAS-METERS

Warranted to Measure correctly & not to vary.

RANELAGH WORKS, RANELAGH ROAD, PIMLICO, LONDON, S.W.

236, GEORGE STREET, GLASGOW, & 30, LANCASTER AVENUE, MANCHESTER.

FOREIGN AGENTS.
DAHL BROTHERS, COPENHAGEN. | W. HOVEN & SON, ROTTERDAM.
A. FAAS & CO., FRANKFORT O/M. | COPLAND & McLAREN, MONTREAL
A. DEMPSTER, 57 ELIZABETH STREET, MELBOURNE.

JOSEPH AIRD,

WELLINGTON TUBE-WORKS, TIPTON, STAFFORDSHIRE,

MANUFACTURER OF

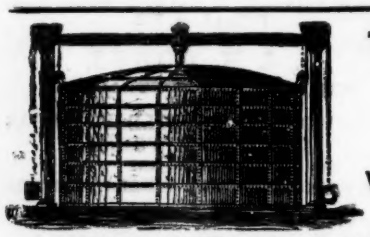
EVERY DESCRIPTION OF TUBING, GAS, STEAM, HYDRAULIC TUBES AND FITTINGS,
EITHER BLACK, GALVANIZED, OR ENAMELLED HOT WATER TUBES AND FITTINGS,
CORE BARS, COILS, COCKS (IRON OR BRASS),
CHANDELIERS, &c., GAS-FITTERS' TOOLS, GAS TONGS, STOCKS, TAPS, DIES, &c., &c.,
HANDRAIL TUBINGS, IRON AND BRASS, PLAIN OR TWISTED,
TELEGRAPH TUBES OR POLES, &c., &c.

LAMBERT BROTHERS, WALSALL.

ALPHA TUBE & FITTING WORKS

Manufacturers of **W. J. WARNER'S PATENT MARKET GAS STAND-PIPE.**

Now ready, GAS CHANDELIER BOOK (Reduced Prices), 7s. 6d.



W. C. HOLMES & CO.,

WHITESTONE IRON-WORKS, HUDDERSFIELD,

MANUFACTURERS OF

RETORTS, ANNULAR AND PIPE CONDENSERS,
WROUGHT AND CAST IRON SCRUBBERS, PURIFIERS,
GASHOLDERS,

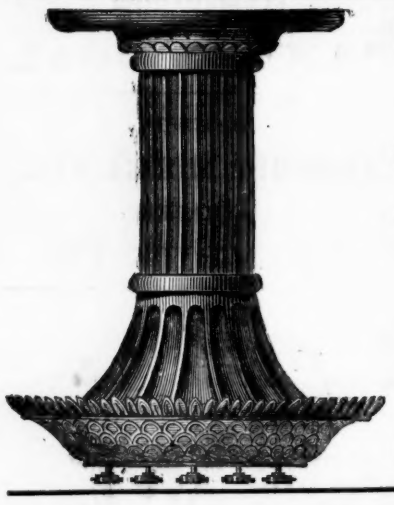
GOVERNORS, AND ALL THE NECESSARY FITTINGS FOR COMPLETING THE ERECTION OF GAS-WORKS.

STATION & CONSUMERS WET OR DRY METERS, STREET & SERVICE MAINS, LAMP COLUMNS & BRACKETS, & WROUGHT-IRON TUBES AND FITTINGS; WROUGHT-IRON ROOFS FOR ANY SIZE OF BUILDINGS.

Sole Makers of B. W. Thurston's Combined Condensing, Scrubbing, and Washing Apparatus,
AND PATENTEES OF THE IMPROVED COMBINED CONDENSING AND PURIFYING APPARATUS SO EMINENTLY ADAPTED FOR EXPORTATION.

REFERENCES TO UPWARDS OF 300 GAS-WORKS.

LONDON OFFICES: 92, CANNON STREET.



HENRY GREENE & SON,

GAS AND HOT WATER ENGINEERS,

155, CANNON STREET, E.C.

Manufactory: 19 & 20, NICHOLAS LANE, E.C.

SUN-BURNERS,

With Regulating Valves to obviate down draught.

MEDIÆVAL & OTHER GAS-FITTINGS

For Churches and Domestic Use.

ARCHITECTS' OWN DESIGNS WORKED OUT.

ESTIMATES FREE OF CHARGE.

THE TRADE SUPPLIED.

SOLE CONSIGNEES FOR BRÖNNER'S IMPROVEMENTS IN GAS LIGHTING.

IN THE MATTER OF

BRÖNNER'S GAS-BURNERS.

HENRY GREENE AND SON, 155, Cannon Street, London, Sole Consignees for Great Britain, Ireland, and Colonies, of Brönner's Improvements in Gas Lighting, inform the public that, on the 20th of April, 1875, Julius Brönner obtained an injunction in Chancery against a defendant prohibiting him from advertising or selling as Brönner's Burners any Gas-Burner not manufactured by Julius Brönner. .

Also, he obtained a similar injunction against another defendant on the 9th of November, 1875.

Also, he obtained a similar injunction against another defendant on the 13th of January, 1876.

Also, he obtained a similar injunction against another defendant on the 16th of March, 1876.

Also, he obtained a similar injunction against another defendant on the 6th of April, 1876.

HENRY GREENE AND SON invite the attention of the trade and public to the above proceedings, which they will continue to maintain against any person infringing Mr. Brönner's rights.

MESSRS. NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS, NEAR SHEFFIELD,

MANUFACTURERS OF

IMPROVED CENTRE-VALVES,

PURIFIERS, CONDENSERS, SCRUBBERS, GASHOLDERS, ROOFS,

And every description of Gas Machinery.

TENDERS GIVEN FOR WORK FIXED COMPLETE IN ANY PART OF THE KINGDOM.

THE

IMPERIAL METER COMPANY,

LIMITED,

KING'S ROAD, LONDON, N.W.,

OFFICE: 115, VICTORIA STREET, WESTMINSTER, S.W.,

MANUFACTURERS OF

"WET" & "DRY" GAS-METERS IN IRON & TIN-PLATE CASES,

STATION-METERS AND GOVERNORS, STREET-LAMP METERS, BOXES, AND REGULATORS FOR THE AVERAGE METER SYSTEM.

Attention is called to their Dry Meters in Wood Cases, as used by the principal London Gas Companies. These Meters are especially suitable for seaport towns and for export.

The Company repair or convert every description of Wet Gas-Meters to De Castro and Burton's Patent.

THE

SILBER LIGHT COMPANY, LIMITED,

49, WHITECROSS STREET, LONDON, E.C.

MANUFACTURERS OF SILBER GAS-BURNERS & FITTINGS.

No. 285.

The Times says: "A considerable improvement upon any burners of the same kind that have hitherto been constructed."

Dr. W. WALLACE, F.R.S.E., F.C.S., says: "After a careful study of the principles of the Argand, I have come to the conclusion that your burner is the best at present known."

The Silber Tubulated Gas-Burner.

No. 291.

The Silber Tubulated Gas-Burner, with Opal Shade and Cup and Governor attached.

The *Lancet* says: "Mr. Silber has obtained a light of singular steadiness, whiteness, and illuminating power, with the great additional advantage of such perfect combustion as to preserve the purity of the atmosphere."

The manager of the gas-works at Southport says: "When our gas is 18 candles with the Standard burner, the Silber gives it as 22. You ought to get it noticed by the gas managers at once."

No. 286.

The Silber Bat's-wing Gas-Burner

The Times says: "Besides the Argand burners, some improved Bat's-wing burners of different sizes were exhibited. In these there is an internal chamber permitting the expansion of the gas before it reaches the flame. They are constructed to burn from two to eight cubic feet of gas per hour, and the illumination they give ranges from 4 to 30 candles, a considerable improvement upon any burners of the same kind that have hitherto been constructed."

THE SILBER LIGHT COMPANY, LIMITED,

Are also Manufacturers of every description of Lamps for Railways, Ships, Streets, Churches, and Domestic Purposes.

FLETCHER AND MURPHY,

GARRATT STREET WORKS, OLDHAM ROAD, MANCHESTER;

Manufacturers of

IMPROVED CONSUMERS WET GAS-METERS

IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

AND

IMPROVED DRY GAS-METERS;

STATION-METERS OF ALL SIZES, with PLANED JOINTS;

GOVERNORS, PRESSURE AND EXHAUST REGISTERS, TEST HOLDERS.

And all kinds of Experimental Gas Apparatus.

WEST'S GAS IMPROVEMENT COMPANY,

LIMITED,

ARE NOW PREPARED TO SUPPLY AND ERECT THEIR PATENTED MACHINERY FOR

CHARGING AND DRAWING GAS-RETORTS,

And to enter into arrangements with GAS COMPANIES for its use upon moderate terms of Royalty.

The Patented Machinery has secured the approbation of all Engineers who have visited the MAIDSTONE GAS-WORKS, *where it is in full operation, and may be inspected at any time on application to the Manager.*

The advantages attending its use are—

INCREASED VOLUME OF GAS PER TON.—INCREASED YIELD PER RETORT.—INCREASED BULK OF COKE FOR SALE.—REDUCTION IN LABOUR AND LESS DEPENDENCE ON SKILLED STOKERS.

A Pamphlet containing a description of the Machinery, and Copies of Reports on the working of the same, &c., will be forwarded on application to the MANAGING DIRECTOR, Maidstone. Communications may also be addressed to the Consulting Engineer, R. P. SPICE, Esq., M. Inst. C.E., 21, Parliament Street, London, S.W., or to the Engineer and Analyst, F. W. HARTLEY, Esq., A. Inst. C.E., 55, Millbank Street, London, S.W.

WHITEHOUSE AND COMPANY, LIMITED,

GLOBE TUBE-WORKS, WEDNESBURY; & VICTORIA TUBE-WORKS, GREAT BRIDGE, STAFFORDSHIRE,

MANUFACTURERS OF

PATENT WELDED WROUGHT-IRON TUBES,

FOR GAS, STEAM, AND WATER;

GAS-FITTERS TOOLS, STEAM COCKS, AND ALL KINDS OF JOINTS.

HYDRAULIC TUBES, CORE BARS, TELEGRAPH POSTS, COILS, &c.

London Agent—ALFRED LAKEMAN, 9, FENCHURCH STREET, E.C.

ROBT. DEMPSTER & SONS,

GAS ENGINEERS, IRONFOUNDERS, AND CONTRACTORS,

ROSE MOUNT IRON-WORKS, ELLAND, YORKSHIRE,

MANUFACTURERS OF EVERY DESCRIPTION OF

GAS APPARATUS;

CONTRACTORS FOR THE

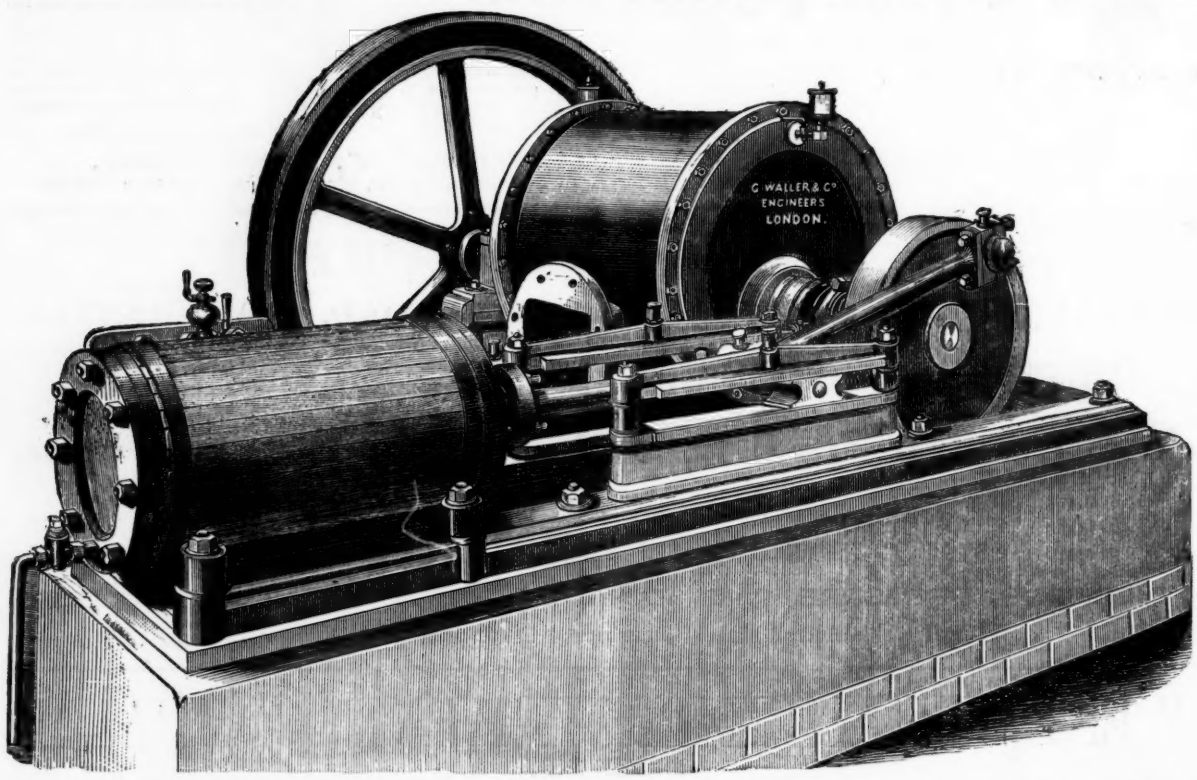
ERECTION OF PUBLIC AND PRIVATE GAS-WORKS.

ARBITRATIONS, VALUATIONS, ASSESSMENTS AND PARLIAMENTARY APPLICATIONS CONDUCTED

Plans and Specifications Prepared, and Illustrated Catalogues forwarded on application.

GEORGE WALLER & CO.,

GAS AND HYDRAULIC ENGINEERS.



BEALE'S IMPROVED PATENT GAS-EXHAUSTERS

AND

HORIZONTAL COMBINED ENGINES.

This arrangement, specially designed and manufactured **solely by G. W. & Co.,** is suitable for Works making 10,000 cubic feet and upwards of gas per hour. The **Exhausters** are of **full capacity** for the quantity of gas to pass, have **wrought-iron spindles** to ensure perfect safety in working, the flanges of cylinders and edges of covers are turned, inlet and outlet flanges turned, faced, and drilled, and the base of each Exhauster is planed. The **Engines** have wrought-iron connecting-rods, with solid gun-metal ends, steel piston and slide rods, turned and polished discs, heavy fly-wheels turned on rim and edge and polished, cylinders are lagged with polished mahogany and brass bands, and the bed-plates are planed on the bottom surface. A heavy bracket and plummer block, with strong gun-metal bearings, support the shaft between the Exhauster and fly-wheel.

Disc Gas-Valves, Self-Acting Bye-Pass Valves, Hydraulic Main Valves, Pumps, &c., always kept in Stock.

Phœnix Engineering Works, Holland Street, Southwark, S.E.

GEORGE ORME & CO.,

ATLAS METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET AND DRY GAS-METERS,

STATION-METERS, GOVERNORS,

PRESSURE AND EXHAUST REGISTERS,

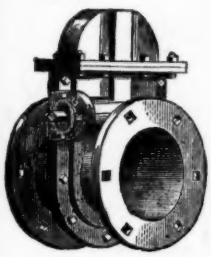
LAMP-METERS IN CAST-IRON BOXES,

And every Description of Gas Apparatus.

B. DONKIN & CO.'S

IMPROVED GAS-VALVES

WITH WROUGHT-IRON PINIONS.



List of prices, with full dimensions of all sizes up to 48-inch, to be had on application.

These Valves are proved on both sides to 30 lbs. on the square inch before leaving the works, and are kept in stock.

ALSO MAKERS OF

J. BEALE'S NEW PATENT GAS EXHAUSTERS,

STEAM ENGINES FOR DRIVING GAS EXHAUSTERS,

VALVES FOR AMMONIACAL LIQUOR,

IMPROVED BRIDGE VALVES FOR REGULATING THE SEAL IN HYDRAULIC MAINS,

BYE-PASS VALVES, SCREW WATER-VALVES.

B. DONKIN & CO., 55a, BLUE ANCHOR ROAD, BERMONDSEY, LONDON, S.E.

J. & J. BRADDOCK,

GAS ENGINEERS,

GLOBE METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET & DRY CONSUMERS GAS-METERS,

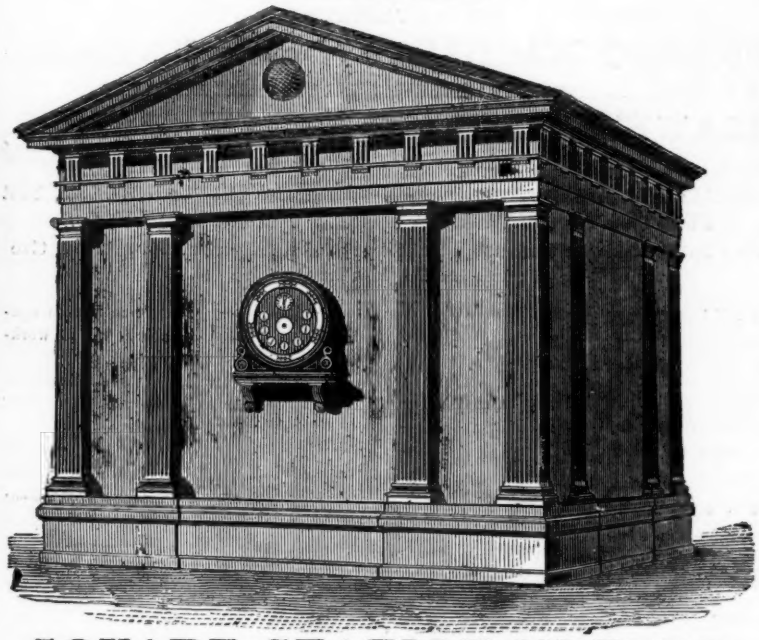
OF THE HIGHEST EXCELLENCE ONLY;

ALSO LICENSEES AND MANUFACTURERS OF

WARNER & COWAN'S PATENT SELF-REGULATING GAS-METERS;

ROUND STATION-METERS,

ON CAST-IRON STANDS.



SQUARE STATION-METERS,

WITH PLANED JOINTS.

GOVERNORS, GAUGES, INDICATORS, MAIN COCKS, &c.

GAS COOKING APPARATUS.

Home and Foreign Orders promptly attended to.

All Sizes of CONSUMERS METERS, STATION-METERS, and GOVERNORS generally in Stock.

Orders almost invariably despatched on the day of receipt.

TERMS, &c., ON APPLICATION.

INTERNATIONAL EXHIBITION, 1862.

CLASS X.

PRIZE MEDAL

For excellence of Fire-Clay Gas Retorts, and "HONOURABLE MENTION" for good quality of Fire-Bricks.

WILLIAM STEPHENSON & SONS,

THROCKLEY,

NEWCASTLE-ON-TYNE.

C. & W. WALKER'S

WOOD PURIFIER SIEVES,

Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

MIDLAND IRON-WORKS,

DONNINGTON, NEAR NEWPORT, SHROPSHIRE.

8, FINSBURY CIRCUS, LONDON.

ESTABLISHED IN 1860.

BENJAMIN CARPENTER,

THE ORIGINAL MANUFACTURER OF THE IMPROVED

WOOD SIEVES

FOR

GAS PURIFIERS & SCRUBBERS.

PROVIDENCE WORKS,

22, HERMES STREET, PENTONVILLE ROAD

LONDON, N.

DEMPSTER & SONS'

RENOWNED

WOOD SIEVES,

WITH TAPER BARS,

MADE BY MACHINERY

CAPABLE OF MAKING 10,000 FEET WEEKLY.

References to Hundreds of First-Class Engineers.

ROSE MOUNT IRON-WORKS,

ELLAND, NEAR HALIFAX.

CATOPTRIC LAMPS.

The NEW PATTERN

Is now placed throughout

CHEAPSIDE.

For Terms of Licence to Use and Manufacture, apply to

Mr. SKELTON,

37, ESSEX STREET,

STRAND.

LAMP-PILLARS,

GAS-LAMPS, FOUNTAINS.

Our New and Choice Designs for the above, with prices, are forwarded to any part of the world on receipt of twelve stamps. Estimates for work at home or abroad.

W. T. ALLEN & CO.,

(Late TURNER AND ALLEN), Established 1847,

GAS & WATER ENGINEERS & CONTRACTORS.

SOMERSET BUILDINGS,

LAMBETH HILL, UPPER THAMES ST.

(Late 203, Upper Thames Street), LONDON, E.C.

THOMAS TURTON AND SONS,

SHEAF AND SPRING WORKS,

SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY FOR ENGINEERS,

STEEL OF ALL DESCRIPTIONS,

SCREW STOCKS, TAPS, AND DIES, SPANNERS,

RATCHET BRACES, LIFTING-JACKS,

ANVILS, VICES,

AND ENGINEERS TOOLS GENERALLY.

LONDON WAREHOUSE:

35, QUEEN STREET, CANNON STREET, E.C.

JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
WENLOCK IRON WHARF, 21 & 22, WHARF ROAD, CITY ROAD, LONDON, N.,
Keep in London and at their works large stocks of PIPES and CONNEXIONS (½ to 36 inches in diameter); also make and supply Retorts, Tanks, Columns, Girders, Special Castings required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
CHARLES HORSLEY, Agent.

BIRTLEY IRON WORKS,
CHESTER-LE-STREET, DURHAM.
Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.
Warehouse in London for Cast-Iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.
Agent in London, Mr. J. MANWARING, 101 Cannon Street, E.C.

STEAM PACKING.
Why not Purchase direct from the Manufacturer?
Self-Lubricating Packing for very High and Low Pressure Steam and Pumps, any size, 1s. 8d. per lb.
This is made from Laid Twine, boiled in Glycerine, &c., &c., mixed with Soapstone and other ingredients, and formed into soft rope of seven strands. It would be impossible to produce Packing of a better quality even at any price. Railway carriage allowed, to be deducted from account, on Seven Pounds and upwards. Tarred and White Yarn for Pipe-Joints, Cotton Waste, &c., at various prices.
E. YEO, Patentee and Sole Manufacturer,
NEWTON ABBOT, DEVON.

THE
SILICA FIRE-BRICK CO.,
OUGHTIBRIDGE,
Near SHEFFIELD,
Manufacturers of THE ORIGINAL SILICA OR DINAS FIRE-BRICKS. Specially adapted for Gas-Retort Furnaces, and for Siemens's Gas-Furnaces. Shipments promptly executed to London, Liverpool, Hull, Grimsby, &c.

TROTTER, HAINES, & CORBETT,
BRETTELL'S ESTATE
FIRE CLAY & BRICK WORKS,
STOURBRIDGE.
Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS LUMPS, TILES, and every description of FIRE-BRICK.
Proprietors of
BEST GLASS-HOUSE POT and CRUCIBLE CLAYS.
Successors to
T. BAKER AND CO., LATE BRIERLEY HILL, STAFFORDSHIRE.

HARPER & MOORES,
PROPRIETORS OF THE
BEST STOURBRIDGE CLAYS,
STOURBRIDGE.
Manufacturers of all Descriptions of
BEST STOURBRIDGE FIRE-BRICKS, LUMPS, AND CLAY RETORTS
Of all Dimensions for Gas-Works,
GLASS-HOUSE POTS & CRUCIBLES
Of every kind.
The Highest Award was obtained by H. & M., at the Philadelphia Exhibition, 1876, for Superior Quality of Manufacture.

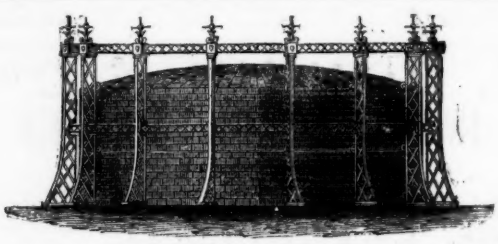
"SELLARS' CEMENT"
PREVENTS WASTE OF GAS FROM RETORTS;
SAVES CLAY RETORTS FROM DESTRUCTION BY FIRE;
GREATLY ECONOMIZES THE USE OF FIRE-BRICKS;
And PREVENTS ALL POSSIBLE LOSS of GAS FROM LEAKAGE.
J. C. SELLARS,
THE GAS CEMENT WORKS,
BIRKENHEAD.

GAS AND WATER PIPES.
WILLIAM MACLEOD & CO.,
23 & 25, OSWALD STREET, GLASGOW.
CAST-IRON GAS AND WATER PIPES.

DELIVERY F.O.B., GLASGOW.
Prices on application.

JOHN HALL AND CO., STOURBRIDGE,
Manufacturers of FIRE-BRICKS, LUMPS, TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.
N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.



THE HORSELEY COMPANY,
LIMITED,
TIPTON, STAFFORDSHIRE.
LONDON OFFICE:
6, WESTMINSTER CHAMBERS, VICTORIA STREET,
GAS ENGINEERS, IRONFOUNDERS, &c.,
MANUFACTURERS OF
GASHOLDERS, WROUGHT AND CAST IRON TANKS, CONDENSERS, PURIFIERS, SCRUBBERS, MAINS, RETORT-LIDS, PLAIN AND DISHED LAMP-POSTS, PIPES,
AND ALL REQUISITES FOR EITHER
GAS OR WATER WORKS;
ALSO
MAKERS OF ROOFS, BRIDGES, &c.

S. OWENS & CO.,
WHITEFRIARS STREET, LONDON, E.C.,
HYDRAULIC ENGINEERS,
AND MANUFACTURERS OF
PUMPING MACHINERY of every Description.
SOLE LICENSEES AND MANUFACTURERS FOR GREAT BRITAIN OF
BLAKE'S PATENT STEAM-PUMPS,
More than 10,000 in use,
ESPECIALLY ADAPTED FOR USE IN GAS AND CHEMICAL WORKS, FOR PUMPING TAR, WATER, AMMONIACAL LIQUOR, ACIDS, &c.
The following are some of the prominent advantages of the BLAKE PUMP:—

It will start at any point of stroke.
It has no dead point.
It works fast or slow, with the same certainty of action.
It is economical. Has a lead on the slide-valve.
It is compact and durable.

It is interchangeable in all its working parts.
It will deliver more water than any other pump.
It is made of best materials in the most workmanlike manner.
Can be worked at 20 strokes per hour, or 200 strokes per minute.

This Illustration represents Boiler-Feed Pumps, Sizes Nos. 1, 2, and 3, with Hand Lever for working Pump when Steam is not available.

SOLE MANUFACTURERS OF
MANN & OWENS
IMPROVED PATENT GAS-VALVES.

PRICED LISTS AND FULL PARTICULARS FURNISHED ON APPLICATION.

TANGYE BROTHERS AND HOLMAN,

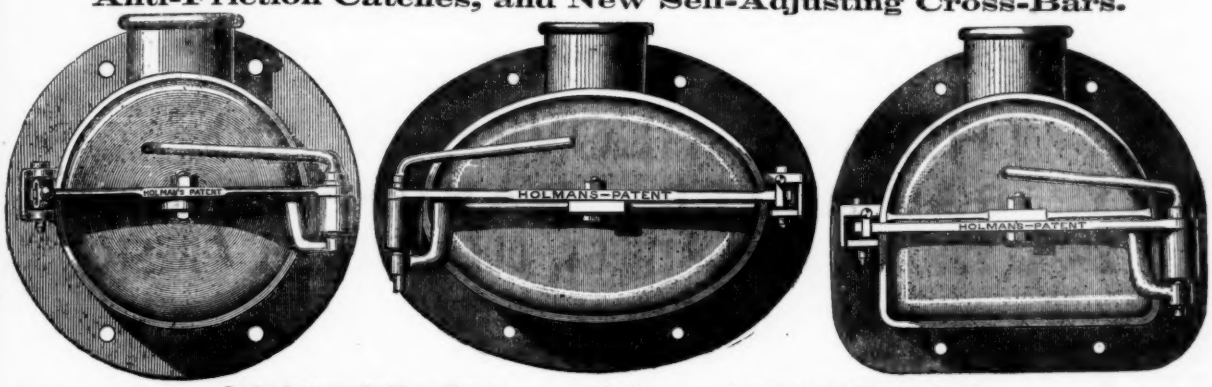
CORNWALL HOUSE, 35, VICTORIA ST., LONDON, E.C.

(LATE OF 10, LAURENCE POUNTNEY LANE.)

SOLE MAKERS OF MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS,

Anti-Friction Catches, and New Self-Adjusting Cross-Bars.



Instantaneous Sealing effected. No Luting. No Duplicate Lids required.

Holman's New Self-Sustaining Cross-Bar ensures freedom of Joint, and maintains parallel position of the Lids.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested, being now in use in nearly all the principal Gas-Works in London and the Provinces.

T. B. and H. are now making the "Morton's Self-Sealing Lid" of the SAME FORM OR SECTION AS THE RETORT (see Illustrations above), as well as bringing the Mouthpiece from the D or Oval at back to Circular in front, as heretofore.

D and Oval Morton's Lids are working satisfactorily both in this country, on the Continent, and in the United States of America. Among others they have been adopted by the following Gas-Works:—

The Gaslight Company's Works, Fulham; Ditto, Bromley-by-Bow; Ditto, King's Cross; Ditto, Shoreditch.
And also in the Gas-Works at Richmond, Maidstone, Gloucester, Glasgow, Portsea, Roubaix (France), The Hague (Holland).

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

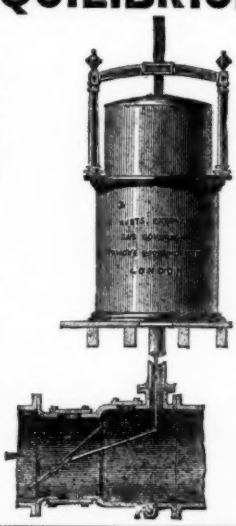
Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at any convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.



These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Guernsey, Halesowen, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Windsor, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

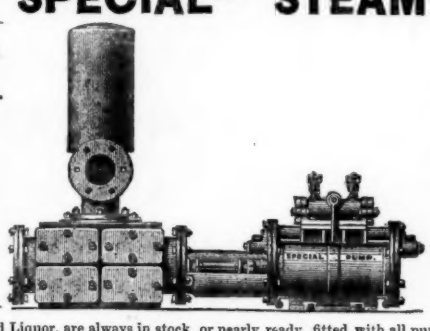
Yours truly,

(Signed) JOHN JOHNSON.

PRICES AND FULL PARTICULARS ON APPLICATION.

THE "SPECIAL" STEAM-PUMP.

Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons of Water per Hour, Approximate.	Reduced Prices.
3	1½	9	450	£16
4	2	9	815	18
5*	2½	12	1,250*	20
5*	3	12	1,830*	22 10
4	4	12	3,250	25
6*	4	12	3,250*	30
5	5	12	5,070	32 10
7*	5	12	5,070*	40
6	6	12	7,330	40
8*	6	12	7,330*	50
7	7	12	9,750	50
10*	7	12	9,750*	65



In use in a Hundred Gas-Works in the United Kingdom for Pumping Ammoniacal Liquor, Water, or Tar.

Messrs. Burt, Boulton, and Haywood, Manufacturing Chemists, have over FORTY "Special" Steam-Pumps in use at their several large Tar-Works.

Two Hundred Sizes made. Those in Table opposite are the leading Sizes for use in Gas-Works and Chemical Works.

* These Sizes being usually selected for pumping Tar and Liquor, are always in stock, or nearly ready, fitted with all pump details in iron, and extra length distance-piece between steam and pump cylinder, at a small extra cost.

TANGYE'S HIGH-PRESSURE AND CONDENSING STEAM-ENGINES; CORNISH, VERTICAL, & TUBULAR BOILERS; HYDRAULIC AND SCREW LIFTING-JACKS, CRABS, PULLEY-BLOCKS, &c.

FULL PARTICULARS, ESTIMATES, CATALOGUES, ETC., ON APPLICATION.

London, 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON & CO.

(SUCCESSORS TO SAMUEL CROSLEY,)

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

MANUFACTURERS OF PATENT

WET & DRY GAS-METERS,

STATION-METERS WITH PLANED JOINTS,

GOVERNORS, PRESSURE REGISTERS, GAUGES,

AND EXPERIMENTAL APPARATUS,

STREET-LAMP METERS,

AND REGULATORS FOR AVERAGE METER INDICATION.

METERS FOR MEASURING WATER.

CONTENTS.

Circular to Gas Companies:— PAGE
Patterson *v.* The Gaslight and Coke Company . . . 941
Gas Affairs at Shotley Bridge . . . 942
Public Lighting at Mile End . . . 942
Busybodies at Sutton . . . 942
The Price of Gas in Rossendale . . . 942
Opposition to the Torquay Gas Company . . . 942
The Hydraulic Stoker at Rochdale and Glasgow . . . 943
Sutton Coldfield and the Birmingham Corporation . . . 942
Adoption of the Burghs (Scotland) Gas Supply Act at Elgin . . . 942
The Corporation of York and the Gas Company . . . 942
Gas Affairs at Hastings . . . 943
Sewage Gas . . . 943
Gas Affairs at Sheerness . . . 943
Lecture on Coal Gas at Salford . . . 943
Dr. Wallace's Analyses of Scotch Coals and Cannels . . . 943
Water and Sanitary Notes:—
Captain Calver's Report on the State of the Thames . . . 943
The Metropolitan Board and the Water Supply . . . 943
The Affairs of the Southwark and Vauxhall Water Company . . . 943
The Rivers Pollution Prevention Act . . . 944
The Prevention of Thames Floods . . . 944
Leading Articles:—
Death of Mr. R. A. Gray . . . 944
House Drainage . . . 944
Analyses of Scotch Coals, Cannel, Splint, Shale, &c., used in the Manufacture of Gas. By W. Wallace, Ph.D., F.R.S.E., F.C.S., &c. . . . 945
Legal Intelligence:—
House of Lords—Patterson *v.* The Gaslight and Coke Company . . . 948
Stockton Borough Police Court—Conviction of a Water Company for Refusing to Supply Water . . . 950
Miscellaneous News:—
Death of Mr. Thomas Cope, of Barnsley . . . 943
Metropolis Water Supply . . . 951
Meeting of the Southwark and Vauxhall Water Company . . . 952
Meeting of the Grand Junction Water Company . . . 956
Sutton Coldfield Gas Supply . . . 956
Increased Water Charges at Wakefield . . . 956
Average Meter System in Paddington . . . 957
Gas Explosion at Manchester . . . 957
York City Council and the Gas Company . . . 958
Hastings Gas Supply . . . 958
Cardiff Gas Supply . . . 958
Gas Affairs at Elgin . . . 959
The Movement of Water in the Chalk Formation. By Mr. Baldwin Latham, M.I.C.E., F.G.S., &c. . . . 960
Trade Reports . . . 960
Birmingham Water Supply . . . 961
Glasgow Water Supply . . . 961
Crawley Gas Company . . . 961
Transfer of the Retford Gas-Works to the Corporation . . . 961
Bolton Public Lighting . . . 961
Sales of Gas and Water Shares . . . 961
Reductions in the Price of Gas . . . 961
Upper Sedgley Gas Supply . . . 961
Monte Video Gas Company, Limited . . . 961
Society of Engineers . . . 962
Local Government Board Inquiry at Croydon . . . 962
Gas Explosions in Scotland . . . 962
Great Grimsby Gas-Works . . . 962
Register of New Patents:—
Applications for Letters Patent . . . 962
Patents which have passed the Great Seal . . . 962
Patents which have become void . . . 962

NOTICE TO ADVERTISERS.

In consequence of the Christmas Holidays, the JOURNAL *will be published on Monday next week. To ensure insertion, advertisements should therefore arrive by Three o'clock on Saturday at latest.*

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

NOTICE TO SUBSCRIBERS.

SCALE OF CHARGES FOR ADVERTISEMENTS.
Six lines and under . . . 3s. 0d.
Sixpence per line for every line additional.
Special contracts for advertisements intended for continuous insertion.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, DECEMBER 18, 1877.

Circular to Gas Companies.

THE case of *Patterson v. The Gaslight and Coke Company* has had the only termination which, in our judgment, could possibly be arrived at. While feeling some sympathy for the plaintiff under his complete defeat, we are bound to say that no other decision than that of the House of Lords would have met the justice of the case. It was a great misfortune to himself when Mr. Patterson took out a patent; it was a greater misfortune to him when he went to law to maintain the validity of it in the face of such evidence as must have been before him. We have before called it an error of judgment, and a most serious error it has proved. It will be seen by the decision, which we print elsewhere, that their Lordships base their conclusions on two grounds—first, the want of novelty in the invention; and, secondly, that the pretended discovery was made by a public officer, who obtained the information in the course of his official duties, and at the public expense. On this latter point we have always had a strong feeling, and we are glad to see that the Lord Chancellor fully agrees with the sentiments which have been expressed in our columns. The Referees are public servants; but they are paid by a tax specially levied on the Gas Companies they supervise. Thus, while public servants, they are, in a more particular sense, the servants of the Gas Companies. The information which Mr. Patterson obtained was procured from the Gas Companies, who further paid the cost of all the experiments which were made in the laboratory of the Referees. We know, of course, that Government officials have patented inventions which were perfected in the Royal laboratories, and that their validity has not been called in dispute. But there is a legal obligation which compels the gratuitous use of such inventions by the Government. Now, if Mr. Patterson, having arrived at his invention, as we may say, at the expense of the Chartered Company, had given them the free use of his knowledge, the suit which has just ended so disastrously for him would never have been heard of, and, as we said a long time ago, he would probably have been a Referee to this day. The whole business has been a series of blunders. The patent itself was a blunder; the temporary suppression of a report on the sulphur purification at Beckton was worse than a blunder, and the attempt to establish the validity of the patent was the greatest blunder of all. From the days of Reuben Phillips, lime has been used in the purification of coal gas, and, whether with intelligence or not, it has, no doubt, with more or less irregularity, produced the same results as will follow more certainly the use of what Mr. Patterson calls his process. We may grant that the greater number of Gas Managers were ignorant of the theory of the chemical principles which explain the removal of bisulphide of carbon by the use of sulphide of calcium. They were, however, understood by some, and the antecedent patent of Mr. Mann shows clearly that he had a perfect knowledge of them. The successful practice of Mr. Harris, as we very well know, years before the patent which has just been disputed was taken out, kept down the sulphur to as low a point as is attainable, we believe, by the use of lime. Thus the patent fails entirely for the want of novelty. The chemical principles involved were thoroughly understood, and those principles were successfully applied.

We shall not go into the subtleties as to prior publication, dealt with by the Lord Chancellor. We, of course, accept his dictum that the communication from one Referee to another at once puts the public in possession of the so-called invention. Our contention is that the whole thing was known, understood, and practised long before the report of the purification at Beckton and the taking out of Mr. Patterson's patent. The consideration for a temporary monopoly, such as it conferred by a patent, is the communication of some valuable and novel invention. There was no such thing in this case. What Mr. Patterson did—and we must give him all due praise for it—was to put clearly before the public an explanation of the principles involved in, and the best mode of carrying out, the purification of gas by lime. It is obvious a patent of this kind could not be sustainable. If it could be, manufacturing operations would be seriously impeded. We should be inundated with patents, which would reduce manufacturers to despair. Free intercourse between employers and employed would be impossible. Each one would regard the other with suspicion, and the only thought would be of concealing an idea until the time arrived to make it the subject of a patent.

With regard to this special case, it is clear that no free intercourse could take place between the Referees and Gas Managers if the latter thought that the information they imparted, and the suggestions they might have thrown out, would be appropriated for the Referees special advantage. The duties of these officers require them to make minute examinations into the several processes carried on in gas-works. We can hardly go the length of Lord Blackburn, and say that every hour of their time belongs to the public; but we do say that, whatever comes of their intercourse with Gas Companies belongs to the Companies. They are not to put Companies to the expense of experiments, and then carry away the results in their pockets. It may be admitted that the present remuneration of a Referee is very insignificant, and if, in the course of his duties, he should hit upon a process which would save a Gas Company some thousands a year, and free them from penalties, it seems hard that he should be debarred from profiting by his invention. The law, however, as laid down in this judgment, says that he shall not do so, and we rather pity Referees with ideas. As to what extent the decision may affect the progress of improvement in gas industry we shall not speculate. For the future we fear Gas Companies will not derive much assistance from the labours of the Referees. Mr. Patterson's case will be a warning.

We rather question whether the Acts of Parliament make it obligatory on the Referees to prescribe processes. It appears to

us that they are only required to examine processes actually in use, and determine what degree of purification can be effected by such means, and to fix the maximum amount of impurity to be allowed in accordance with the results they witness. That, we take it, is the plain meaning of the Act of 1868, and subsequent enactments, including the same clauses. Thus, in fixing a maximum, account can only be taken of processes at present in use at individual works, and of conditions now obtaining therein. Originality is not required at their hands. Plain duty rests with them to investigate existing means, and see that the best use is made of them. If, in an enthusiastic and generous spirit, they design processes and apparatus calculated to produce better results, this judgment shows them that, for remuneration for their ingenuity and skill, they must look to some other source rather than a patent monopoly. It is quite right, but it is hard to be generous on £200 a year. We have said before that we sympathize with Mr. Patterson, for the work he did was undoubtedly valuable. In formulating, as we may say, the *rationale* of the purification of gas by lime, he unquestionably rendered an essential service to gas managers, who, with his patent in their hands, can work their purifiers to the utmost advantage. Still the patent was bad, and we are glad to find it upset. The special misfortune to Mr. Patterson is that one part of a patent being held to be untenable, the whole is vitiated, and thus he loses his right to the methods of purification in closed vessels, of the success of which we had, and still entertain, great expectations. It may now be too late for a disclaimer, and Mr. Patterson will thus always have to regret the false step he took in commencing the action which is now brought to a conclusion.

The Directors of the Shotley Bridge Gas Company seem to have been an easy-going set. There is an Iron Company in their district who have built streets of cottages for their workpeople. But these are not, in a legal sense, public thoroughfares. Nevertheless, the Gas Company consented to supply *quasi*-public lamps within them without a guarantee. No sooner had they done so than the Iron Company decided on tearing up some of the streets for the purpose of widening them, and disturbed all the pipes of the Gas Company, which they expect to be replaced at the Company's expense. The latter have at last refused, very properly, to light any more such private streets. They are under no legal obligation to supply them with gas unless under special guarantees, which they have every right to exact. The Local Board have taken up the cudgels against the Company, and have threatened them with competition with the electric candle and oil lamps. The consideration of the former mode of illumination has been wisely deferred for a time; and, as regards the latter, the only determination arrived at is to light two urinals with petroleum lamps. The misfortunes of a Gas Company very frequently begin when, from generous motives, they depart from a strict line of legality. Our Shotley Bridge friends had better, for the future, exact all the rights Parliament has conferred upon them.

It is extremely difficult to satisfy Local Boards with respect to the supply of public lamps. The complaints which reach us, in considerable numbers each week, show the great amount of dissatisfaction all over the country. Conciliation and concession seem to produce no good results. The best thing then that a Gas Company can do, as is said above, is to stand upon their legal rights. They should fix a price, and adhere to it, remonstrance notwithstanding. This the Commercial Company have very properly done in their dealings with the Mile End Vestry, who expressed a wish to get the supply to public lamps cheapened. The Company are by no means stingy with their supply. In our occasional visits to the East of London we have observed lamps burning by far more than the contracted-for amount of gas. The contract price per lamp, calculated for the stipulated quantity, is, the Company state, below the rate charged to private consumers. Thus the Vestry can have nothing to complain of, and must adhere to their bargain.

The danger which attends contentious people is illustrated in a small way by what has befallen the committee who, practically self-elected, undertook to watch the interests of the Sutton consumers when the Gas Company were before Parliament last year. The expenses incurred were £156. The consumers, whose interests were carefully watched over, have contributed by subscription £93. Thus a deficiency of £63 has to be made up, and it would seem that there is no other source from which it can come but the pockets of the committeemen. It is a very small matter, but it may be a caution to busybodies.

The agitation in Bacup has not been without effect on the Rossendale Union Gas Company, the Directors of which, in reply to a deputation of consumers who recently waited on them, announce their intention to reduce the price of gas threepence per thousand after the 1st of January next. The announcement should have been made earlier, or not at all. We utterly deprecate the idea of Gas Companies acting under compulsion. They should conduct their business having regard to their own interests and those of their customers. Ten per cent. is not, unhappily, attainable everywhere, and the Rossendale Company may be content with smaller profits in order to live in peace with their consumers.

The Torquay Gas Company are going to Parliament for fresh powers. We have not yet seen the Bill they are promoting, but we gather from a local print that they are seeking authority to capitalize expended profits. Nothing more just or reasonable can be conceived. Purchase is talked of at Torquay, and if it were effected the Local Board would find the amount of these profits in works and plant. That gas should be dearer in Torquay than Plymouth is no wonder. The circumstances of the two Companies are quite different, and, from natural causes and commercial exigencies, the price of gas in Torquay is higher than in Plymouth. The gas undertaking of the latter place has been managed with extraordinary ability, but we doubt whether the skill of the past or present manager could have supplied gas at the same price in Torquay.

At the Rochdale Gas-Works they have been unfortunate with the hydraulic stoker. We mention this in case a report should get abroad that the machine has proved a failure, which is not the fact. Some confusion has evidently occurred with regard to the size of retorts and scoops, and it may be that obstacles to success were interposed by men interested in the continuation of hand labour. So far, however, as we can ascertain, the machine was for a time undoubtedly successful, and, when the retort-benches have been reconstructed, there can be no doubt that all it promises will be fulfilled. Every one who has to superintend the introduction of machinery, in substitution for hand labour, knows well the extraordinary difficulties that have to be encountered. But we believe that the Foulis machine will eventually come well out of the trial. There is only one thing that occurs to us with respect to this machine, and that is that, if compressed air were substituted for water, the work might be done cheaper, and in a much more efficient and cleanly manner. The parts of the machine would require but little alteration; but, with that alteration, we believe its efficiency would be improved, and the floor of the retort-house would be made more comfortable.

We notice with regret that the hydraulic machines are not working with perfect satisfaction even at Glasgow; but it is reported that some inconsiderable repairs will put them in perfect working order. We remark, with some astonishment, complaints of the public lighting in Glasgow. When, not long ago, in that city, we became half converted to the corporate management of gas undertakings, by observing the prodigality with which light was supplied. We are speaking, of course, of the centre of the city, the lighting of which will compare favourably with that of any city in the world.

Sutton Coldfield has resigned itself. The quaint old Corporation have very foolishly taken a legal opinion, and have, at some cost, been convinced that they have no power to prevent the Corporation of Birmingham from laying their gas-mains within the district. Our concern is for the local Gas Company, who ought, however, to be able to compete with Birmingham in the matter of price. This done, the Gas Committee of Birmingham are not likely to extend their mains far into the district of the Sutton Coldfield Gas Company.

Elgin has, after some months consideration, resolved to adopt the Burghs (Scotland) Gas Supply Act, and are intent on making a compulsory purchase of the Gas Company, who, up to this time, have had a tolerably prosperous career, and will, no doubt, resent interference. Successive bonuses have made ten pound into sixteen pound shares, on which at the present time six per cent. is being paid. Supposing the Company to go into arbitration, the burgh will have a smart price to pay for the undertaking. The shareholders will not suffer, but we do not see how the burgh is to be benefited.

The Corporation of York have innocently appointed a committee to watch the progress of the Bill to be promoted by the Gas Company. They might have saved themselves the trouble, for all they seem to require will have been granted by the spontaneous action of the Company, and, if not, would have been secured by Mr. Raikes and Lord Redesdale. All that a Gas Company are now allowed on ordinary shares and stock is seven per cent., and to this amount the York Company will certainly be limited. It is not pleasant to see the smallest hostility displayed to a Gas Company who have served a community so well as the York United Gas Company. The desire to make them remove their works beyond the limits of the city is unreasonable. The notion that the citizens may be compelled to pay interest on miles of unproductive mains, carried into neighbouring villages, is absurd. A differential rate of price, which would, of course,

be enforced, would set that matter right. We sincerely hope that the York Company's Bill will pass unchallenged.

The Town Council of Hastings have resolved on promoting a Bill to enable them to set up competing gas-works, but as it is too late to introduce any such measure in the ensuing session, they will have time to think better of it, and may, in the meanwhile, become convinced of their powerlessness in the matter. It is a great pity that the Town Council and the Company cannot agree as to the price at which the public lamps should be supplied. It is quite useless to quote statistics on this point, for the circumstances of no two companies and no two towns are alike. Every Gas Company must make its profit, and some on the coast labour under disadvantages which are not apparent to the casual on-looker. The cost of coal to the Hastings Gas Company is, we have little doubt, higher than that of the old Brighton Company, and that, without any other consideration, would render it impossible that gas should be supplied at the same price to both places.

So long as sewage continues to flow, there will, we imagine, be people who will endeavour to make profitable use of it. The natural destination of sewage is land, which it is calculated to fertilize. But at the present moment sewage farming is but ill understood, and no real success has yet been achieved. That there may be successful results at a future day we do not doubt, but we speak of only to-day. Another supposed use of sewage is for the production of illuminating gas. That is a dream which many have dreamt, and under which some have had a nightmare. The dreamers are at present at Stoke Newington, where a flame has been exhibited which, to say the truth, we have not seen. It does not matter, for we regard sewage gas as an utter delusion.

The more Gas Managers come into communication with their customers, the better the feeling that is established between companies and consumers. One of the best ways in which a manager can bring himself into more intimate relations with the public is by the delivery of a popular lecture on the subject of his special manufacture. Gas is a mystery to the majority of men, but they would gladly know something about it, if some one would take the trouble to teach them. Mr. S. Hunter, we are glad to see, has attempted the task of enlightening the people of Salford on the subject, and has achieved great success. A very crowded audience testified to the interest the public take in gas, and their desire for knowledge respecting it. Mr. Hunter, we understand, has been requested to re-deliver his lecture both in the North and South. As soon as the state of our columns permits, we shall present our readers with a report of the lecture.

The Directors of the Isle of Sheppy Gas Company have decidedly refused to supply the public lights in Sheerness at a loss. The Chairman of the Local Board seems to think that the privilege of opening the streets should be paid for in some way or other; but he appears to forget the fact that the Company have to reinstate the roadways, and that, moreover, the Company are large ratepayers. Seeing the small consumption of gas in the public lights of Sheerness, and considering that a low price to private consumers may be said to add to their rate-paying power, we believe that the price charged for public lamps in that town is perfectly reasonable. As is usual in these days, a threat is made to light the streets with petroleum, a menace we recommend the Gas Company to utterly disregard.

We publish to-day an extensive and valuable series of analyses of Scotch cannels and coals, made by Dr. Wallace, of Glasgow. We believe nearly every one of these coals is still in the market, though many are almost exhausted, especially the richer qualities of cannel. The worth of these analyses is very great, and the publication of them, we are sure, will be duly appreciated by our Scottish readers, to whom they will serve as a guide in making purchases of coal. It will be seen that the analyses partake of a thoroughly practical character, and the results are recorded in a form which will be well understood by all intelligent Gas Managers. In our "Treatise on the Manufacture and "Distribution of Coal Gas" we have already published a large number of analyses of coals found in the United Kingdom, and these, with those we now print, will, we think, constitute the most extensive record of the examinations of coal for gas-making purposes in existence. We regard their publication with some degree of pride, and express a hope that they will prove of the utmost value to our readers.

Death of Mr. Thomas Cope, of Barnsley.—The announcement is made of the death of Mr. Thos. Cope, on the 1st inst., in the 81st year of his age. The deceased, who had occupied many public positions in his native town, had been a director of the Barnsley Gas Company since 1854, and for eleven years filled the office of chairman, with great satisfaction to his colleagues and the shareholders generally.

Water and Sanitary Notes.

Every attentive observer of the state of the water in the Thames as it flows through the Metropolis, and even for some distance above, must have been conscious that it contained a large amount of suspended sewage matter, which was washed backwards and forwards by the tide. He might not, however, be altogether prepared for the revelations in a report on the state of the river bed, recently made to the Conservancy Board by Captain Calver, R.N. It was not to be supposed that the sewage discharge from Barking and Crossness would travel steadily seawards. It was always expected that the tides would carry the matter backwards and forwards for some distance; but then it was imagined that the movement of the water would be sufficient to keep most of the solid matter in suspension. The report of Captain Calver, however, shows that this is not the fact. He has found large accumulations of sewage mud extending upwards as far as Battersea and Chelsea. Both as regards navigation and the state of the river in relation to health, this is a very serious matter. A hot, dry summer would probably reproduce that state of things which, some years ago, rendered the Committee Rooms of the Houses of Parliament uninhabitable. It seems that the duty of removing the filthy accumulations devolves upon the Metropolitan Board of Works, and will prove an onerous and expensive business; but it must be done, and ought to be commenced at once.

The report opens out a rather gloomy prospect for the metropolitan ratepayer. It would seem clear that no long time hence the present outfalls will have to be abandoned, or some plan for the defecation of the sewage adopted. Any plan of treatment would involve great expense, and produce no return. To take the sewage out to sea would cost several millions, and after that expenditure London would be in danger of being revisited by its excreta. It is no wonder that, under the circumstances, the idea of reviving the Maplin Sands scheme has occurred to some minds. As a commercial speculation, that scheme could, of course, never answer, but as a metropolitan undertaking we think it offers a profitable disposition of London sewage. The return would, indeed, be small; but, at present, there is no return at all, nor would there be if the sewage were sent directly to the sea. Irrigation, in the ordinary sense, with the vast mass of London sewage, is out of the question. The Maplin scheme, if it be really feasible in an engineering point of view, seems to offer the only chance of making London sewage productive.

The report of the Committee of the House of Commons on the Metropolitan Fire Brigade fell on Spring Gardens like a bombshell. The Metropolitan Board seem only to have just recovered from the fright, and now we have a reply, in the shape of a report from the Works and General Purposes Committee of the Board. That the Board should object to have the management of the Fire Brigade taken out of their hands, and transferred to the Commissioners of Police, is not to be wondered at, though no one knows what honour, glory, or profit, the Board derive from having it in their hands. At the present moment, however, and taken in conjunction with the new water scheme, this report possesses much interest. The excuse of the new scheme is the Fire Brigade, which, in turn, furnishes an excuse for the new scheme. To allege that municipal control of the water is necessary for the proper provision for the extinguishing of fires, is contradicted by facts. Only last week the Water Committee of the Common Council, accompanied by Captain Shaw, and some members of the Metropolitan Board, made further experiments with some of the hydrants fixed in the City on the mains of the New River Company. Universal satisfaction was expressed at the result, and the Common Council have now resolved on completing the system of hydrants throughout their limits. It would seem clear that the Metropolitan Board will receive no assistance from the Corporation of London in their filibustering attempt on the Water Companies, nor is it likely that, with the result of these experiments before them, the Corporation will support the introduction of a new supply, which is clearly shown to be unnecessary. If some of the other Metropolitan Water Companies would wake up to a full sense of their responsibilities and obligations, every excuse of the Metropolitan Board would be removed.

There are some things about which the less said the better. Among these, to-day, are the affairs of the Southwark and Vauxhall Water Company. It was sufficiently mortifying to shareholders to hear that the Company had earned a dividend of six per cent., but that, in consequence of circumstances that need not be recapitulated here, the Directors could only recommend the payment of two per cent. per annum. Nor are the immediate prospects brilliant. It seems clear that heavy expenses on revenue account will be incurred within the current six months, and two per cent. probably will be all the shareholders will get

for the whole year. As to the causes which have brought the Company to their present condition, we can, of course, say nothing. Hard words were used at the meeting, which may, or may not, be justified. Some of the matters in dispute will presently come before a court of law; so we shall soon have further revelations. At the present, we can only advise the Directors to push on their alterations and improvements with all possible speed, for the Company's water is in bad odour, and they have to face a parliamentary committee next year. The only argument that could be used with effect against the designs of the Metropolitan Board is that the Companies are in a position to do all proposed by the Board. We agree with Mr. Wyatt as to the necessity of a combination of the Companies in the coming struggle. A principle is involved, and no Company can singly defend its position. Union, it is said, is strength, and to combat the Metropolitan Board all the Companies must be united.

The Rivers Pollution Prevention Act has been put into active force at Salisbury by the intervention of a landed proprietor, and at Paisley and Rutherglen by the Clyde Trustees. Salisbury discharges its sewage into the Avon, which river passes through the property of a Mr. Jervoise, whose repeated remonstrances have had no effect on the Corporation of the ancient city. He has now served notice of his intention to apply for an injunction, giving the Corporation two months notice, in order to allow time to consider what steps they will take. The Clyde Commissioners are quite as peremptory. It is a misfortune that, as a general rule, Municipal Authorities always put off the consideration of questions until they are, in some way or other, forced upon their attention. The sewage question has been under discussion some years, and the Authorities of Salisbury, Paisley, and the rest, must clearly have seen that the day was not far distant when they would be compelled to take steps for the purification of their sewage. Yet nothing has been done, and the question will have to be considered *de novo*. This is a grand day for precipitation schemers, for, in some of the places named, no other plan of purification would seem possible.

The Vestries and Districts Boards of Lambeth, Wandsworth, St. Saviour's, and Westminster have memorialized the Home Secretary, praying that the Government will introduce a Thames Floods Prevention Bill, in accordance with the recommendations of the Committee of the House of Commons. No answer, so far as we know, has yet been vouchsafed to the memorialists, but we do not see how the appeal can be resisted. The question is so entirely metropolitan, that the work must eventually be done at the expense of the whole Metropolis, and it must be done at once, let northern vestry delegates say what they like. The ensuing spring will bring floods which may have more disastrous results than any preceding, and it would be well if the Metropolitan Board gave immediate attention to the matter.

DEATH OF MR. R. A. GRAY.

"On the 10th inst., at his residence, The Terrace, Camberwell, "Robert Alexander Gray, Esq., J.P., Deputy-Lieutenant of the "County of Surrey, in his 90th year." In these laconic terms it was announced in the daily papers last week that this venerable man, whose name and appearance were so well known to our metropolitan readers, had, after a long and honourable career, passed to his rest. For some time past increasing infirmities had withdrawn Mr. Gray from public duties, yet it seems but as yesterday since he occupied a foremost place in "the battle of life." Although personally acquainted with him for very many years, we have no intention of attempting to give here a biographical sketch of our esteemed friend. Loving and able pens have already recorded his long and successful labours in connection with philanthropic and religious work in the South of London, and there are many living memories of his generous nature and unostentatious piety. We have only to speak of him as associated with the special industry to which the JOURNAL is devoted, to which he gave a large amount of earnest and intelligent service, and was recognized as one of its most able and influential supporters.

Mr. Robert Alexander Gray was born in September, 1788, and when he grew to manhood was a partner in the firm of Melhuish and Gray, shipowners. In 1814 he married the daughter of Mr. Timothy Stansfield, of New Cross. Mr. Stansfield was early connected with, if not one of the promoters of, "The City of London Gaslight and Coke Partnership," and his name appears in the first Act of Parliament conferring incorporation upon that adventure. It may be supposed that it was owing to his union with this family that Mr. Gray first became interested in gas affairs. In 1829 he was elected a Director of the City Gas Company, and after the death of his brother-in-law—Mr. Josiah Stansfield—he became Chairman, in the year 1849. From that time until the undertaking was amalgamated with the Chartered Company, in 1870, Mr. Gray continued to fulfil the duties of that office with a zeal and ability which were thoroughly appreciated by the great body of his fellow-shareholders. It was a stormy time for the Company when Mr. Gray assumed the Chairmanship, and great wisdom and prudence were necessary in the management of their affairs. An agitation for "cheap gas" had commenced in the City, fostered by the late City Solicitor and many members of the Commission of Sewers, who were keenly desirous of establishing a new Company, to divide with those already existing the supposed large profits they were deriving from the supply of gas. The history of the Great Central Company, with its early pretensions, its chequered progress, and its ultimate absorption, at the supreme crisis of its existence, is written at length in the JOURNAL OF GAS LIGHTING, and we only allude to it here for the purpose of adding that throughout the struggle from which it sprang, and during its militant career, Mr. Gray was its unflinching and determined opponent, regarding it from its inception to its consummation as an uncalled-for and unwarranted interference with the property of those who had embarked their capital in the supply of gas when the prospects of success were very limited. The original incorporation of the City Company, in 1817, was for a period of forty-six years only, and accordingly, in 1859, the Directors, anticipating the close of their charter, applied to Parliament for perpetual incorporation. In this they were opposed by the Authorities of the City, and Mr. Gray again fought the battle of his Company, and brought them successfully through the struggle. The several parliamentary inquiries which culminated in the passing of the Metropolis Gas Act, 1860, witnessed Mr. Gray's unremitting attention to gas interests, and, indeed, throughout every subsequent investigation, down to the period when, under the City of London Gas Act, 1868, a scheme was adopted for the amalgamation of the second into the first gas undertaking of the Metropolis, Mr. Gray was always an active and guiding spirit. Ever at his post, and ever ready for the fray, when duty called for it, in defence of the right, Mr. Gray was of a very genial disposition, and his most determined opponents bear witness to the nobility and integrity of his character, and the unswerving rectitude of all his actions. He was largely connected with almost every Gas Company in London, and, until recently, his face was one of the most familiar of those seen at the meetings of shareholders, where his remarks were always listened to with special interest and attention.

HOUSE DRAINAGE.*

The able engineer of the Nottingham Corporation has published a little work which we can strongly recommend to every one engaged in house-building, and which is well worthy the attention of every sanitary authority. It deals with the arrangements to be made for the conveyance of all sorts of household refuse from the house to the sewers, and also the means for getting rid of storm water. If we were disposed to take objection to the plans laid down by the author, we should only advocate the freest openings of sewers and drains to the external air. Traps are delusions and snares; they are rarely in good condition, and cannot easily be kept in safe operation. An exception may be made in favour of the syphon trap recommended by Mr. Tarbotton, but even this form is, to some extent, delusive. Ventilation of drains by pipes passing up to the roofs of houses is of doubtful efficiency. Its usefulness depends on atmospheric conditions which we cannot control, unless we use artificial means for creating a draught. Many such means have been tried, but have, for the most part, resulted in failures. The simplest and most efficacious means of ventilating sewers and drains is, as we have said, to leave free openings to the air. These should, of course, be at the most distant point possible from the house. With regard to closets, the evil effects ascribed to them result from closed doors and windows. Every closet should have the freest access of air. It should have a window, which ought always to be open, and the door should never be closed, except when the closet is occupied. With regard to the regulations respecting water storeage, we, for the most part, agree with the author; but we think he should have insisted on the removal of rain-water store-tanks as far as possible from the house. We have on several occasions been called to advise when, from the decomposition of organic matters, storm waters have become abominably offensive. The stench is probably quite harmless, but it is very disagreeable. It does not last long, and a small quantity of Condy's fluid will remedy it in a few minutes. The recommendations about flushings are very proper. The popular idea is that a constant dribble of water is sufficient to keep a drain-pipe clear; but every practical man knows that this is most fallacious. To flush any length of horizontal pipe requires a considerable volume of water, and even under a constant service system the flushing would involve trouble. Of course, if pipe-drains be laid at proper gradients, but little flushing is necessary. The pamphlet is illustrated with drawings, which will be found of the greatest use to architects, builders, and surveyors.

* "House Drainage. Regulations to be observed in the Drainage and Water Supply of Town and Country Houses." By M. Ogle Tarbotton, M.Inst.C.E., &c. The regulations are adopted by the Corporation of Nottingham and other Sanitary Authorities. London: Spon and Co., 1877.

ANALYSES OF SCOTCH COALS, CANNEL, SPLINT, SHALE, ETC., USED IN THE MANUFACTURE OF GAS.

By Wm. Wallace, Ph.D., F.R.S.E., F.C.S., Public Analyst and Gas Examiner for the City of Glasgow.

The greater number of these analyses have been made with an experimental apparatus constructed specially for the testing of coals in such a manner as to give reliable practical results. The charges weighed 22·4 lbs., and several trials were made of each sample. Gas of 18 to 33 candles illuminating power was tested by the Glasgow standard burner, a union or fishtail jet consuming 5 cubic feet per hour, at a pressure of 5-10ths of an inch. Gas of higher quality was tested with a union jet consuming 3½ cubic feet per hour, at 9-10ths of an inch pressure, and gas of lower quality with Sugg's New "London" Argand. The coke was weighed in a specially constructed balance immediately on being removed from the retort, and before quenching with water.

Name of Coal.	Date of Analysis.	Physical Properties.			Volatile Matters.				Coke.					Coke per Cent.			Gas.					
		Thickness of Seam in Inches.	Specific Gravity.	Weight of a Cub. Foot.	Gas, Tar, &c.	Sulphur.	Water, at 212° F.	Total.	Fixed Carbon.	Sulphur.	Ash.	Total.	Pounds per Ton.	Carbon.	Sulphur.	Ash.	Cubic Feet per Ton.	Illuminating Power.	Value of a Cub. Foot in Grs. Sperm.	Sperm in lbs. per Ton.	Durability, 5-in. Flame.	Gravity.
																					Min. Sec.	
Allanshaw Wallsend (soft)	1877	84	1·265	79	34·03	·13	10·04	44·20	53·35	·15	2·30	55·80	1250	95·61	·27	4·12	9,590	17·55	421	577	43	475
Allanton cannel	1868	11	1·305	81	36·29	·23	6·96	43·48	52·09	·15	4·28	56·52	1266	92·17	·26	7·57	9,066	21·35	512	792	51	486
Allanton soft coal dross	1875	—	1·240	77	30·29	·77	9·57	40·63	51·54	1·15	6·68	59·37	1330	86·81	1·94	11·25	11,250	15·08	362	582	44	453
Auchengray	1874	—	1·333	83	33·34	·68	7·50	41·52	44·88	·80	12·80	58·48	1310	76·74	1·37	21·89	10,080	25·19	605	871	55	531
Auchlochan	1876	—	1·276	80	38·94	·07	6·09	45·10	47·02	·04	7·84	54·90	1230	85·65	·07	14·28	9,310	26·97	647	860	55	549
Avonhead shale	1872	6	1·765	110	33·50	·33	2·10	35·93	16·68	·49	46·90	64·07	1435	26·04	·76	73·20	9,405	27·69	664	892	—	—
Arniston, No. 1	1874	—	1·224	76	50·61	·59	3·27	54·47	40·64	·69	4·20	45·53	1020	89·26	1·51	9·23	13,015	32·88	789	1467	68	599
Abercorn (Johnstone) shale	1872	11	1·578	98	34·00	·75	1·76	36·51	16·47	·62	46·40	63·49	1422	25·94	·98	73·08	8,306	36·46	875	1038	—	—
Auldton (Larkhall)	1875	—	1·276	80	37·78	·12	6·75	44·65	47·04	·09	8·22	55·35	1240	85·00	·16	14·84	10,490	27·35	656	983	57	536
Armadale (Boghead)	1873	4—9	1·218	75	63·40	·10	1·04	64·54	14·83	·05	20·58	35·46	794	41·82	·14	58·04	14,718	40·25	966	2031	—	—
Balbardie, No. 1	1870	7	1·212	76	51·01	·07	1·64	52·72	44·56	·10	2·62	47·28	1059	94·25	·21	5·54	11,479	34·30	823	1350	63	546
Balbardie, No. 2	1870	3½	1·429	89	38·33	·03	3·64	42·00	33·25	·03	24·72	58·00	1271	57·33	·05	42·62	9,938	29·92	718	1019	58	—
Balquhatston caking coal	1875	17—26	1·260	79	27·27	·17	2·47	29·91	67·05	·26	2·78	70·09	1570	95·66	·37	3·97	9,800	16·39	393	550	45	450
Bank (Ayrshire)	1874	—	1·250	78	39·12	·23	5·45	44·80	50·80	·18	4·22	55·20	1237	92·03	·33	7·64	10,650	26·51	636	968	—	—
Bank (5-foot seam)	1869	16½	1·277	80	41·07	·03	3·30	44·40	52·25	·05	3·30	55·60	1245	93·97	·09	5·94	9,770	27·07	650	907	56	—
Bank (main seam)	1869	16	1·304	81	36·25	·10	1·70	38·05	54·41	·14	7·40	61·95	1388	87·83	·23	11·94	—	—	—	—	—	—
Bankend (Monkland)	1873	10	1·279	80	42·10	·38	5·74	48·22	42·23	·30	9·25	51·78	1160	81·56	·58	17·86	10,703	24·62	591	904	—	—
Bannockburn soft coal	1874	—	1·237	77	32·90	·07	2·75	35·72	61·94	·02	3·22	64·28	1440	94·96	·03	5·01	11,470	14·26	342	560	40	411
Barr coal	1874	—	1·305	81	48·19	·31	3·29	51·79	30·34	·37	17·50	48·21	1080	62·93	·77	36·30	10,750	39·85	956	1468	—	—
Banachnie	1872	—	1·304	81	37·55	·20	8·08	45·83	43·23	·28	10·66	54·17	1213	79·80	·52	19·68	10,420	21·13	507	755	—	—
Banachnie gas and splint	1872	—	1·304	81	35·40	·12	6·00	41·52	51·21	·18	7·09	58·48	1310	87·57	·31	12·12	10,060	19·59	470	675	—	—
Barr Mill (Westwood) shale	1873	—	1·428	89	37·98	·66	3·10	41·74	20·54	·50	37·22	58·26	1305	35·26	·86	63·88	9,675	43·56	1045	1444	—	—
Bathgate (Hopeton)	1873	—	1·463	91	32·90	·34	5·60	38·84	41·14	·40	19·62	61·16	1370	67·26	·65	32·09	9,403	25·95	623	837	53	500
Benhar Baton coal or shale	1875	9	1·363	85	26·58	·29	1·25	28·12	51·88	·35	19·65	71·88	1610	72·17	·49	27·34	9,035	29·75	714	921	59 30	535
Benhar jewel coal (bituminous)	1876	22—26	1·271	79	38·54	·22	5·89	44·65	50·56	·25	4·54	55·35	1240	91·35	·45	8·20	10,375	17·69	424	628	41 35	443
Blackstone (Johnstone) shale	1873	12—14	1·695	105	34·48	·62	1·45	36·55	13·40	·95	49·10	63·45	1420	21·12	1·49	77·39	7,800	36·77	882	983	—	—
Blacktongue splint	1877	—	1·250	78	32·87	·33	4·30	37·50	59·72	·50	2·28	62·50	1400	95·55	·80	3·65	11,050	16·41	394	622	38	451
Boghead (Torbanehill)	1872	22	1·224	76	60·40	·18	0·80	61·38	9·01	·06	29·55	38·62	865	23·33	·15	76·52	15,120	44·57	1070	2311	82	720
Boghead, average of five pits	1876	9—22	1·304	81	54·42	·20	1·60	55·62	11·13	·10	33·15	44·38	994	25·08	·23	74·69	14,680	39·81	955	2003	74 6	650
Boghead (Monkland)	1873	—	1·218	76	63·40	·10	1·04	64·54	14·83	·05	20·58	35·46	794	41·82	·14	58·04	14,718	40·25	966	2031	—	—
Braehead cannel	1874	28	1·305	81	39·00	·07	3·80	42·87	40·27	·02	16·84	57·13	1290	70·49	·04	29·47	10,650	29·92	718	1092	58 30	546
Braehead splint	1874	18	1·250	78	38·34	trace.	8·10	46·44	50·37	·04	3·15	53·56	1200	94·04	·08	5·88	9,610	23·79	571	784	52 10	510
Braehead, whole seam	1874	46	1·250	78	39·82	·09	4·74	44·65	48·89	·06	6·40	55·35	1240	88·33	·11	11·56	10,575	27·38	657	992	56	530
Braidholm	1868	21	1·225	76	50·90	·26	2·18	53·34	38·60	·16	7·90	46·66	1045	82·73	·34	16·93	11,902	29·62	711	1209	—	—
Cadzow cannel	1877	7	1·265	79	36·66	·16	7·70	44·52	51·41	·21	3·86	55·48	1243	92·66	·38	6·96	10,095	22·41	538	775	50 40	468
Cadzow splint	1877	63	1·271	79	36·52	·14	8·44	45·10	50·96	·18	3·76	54·90	1230	92·82	·33	6·85	9,895	18·04	433	612	43	436
Cairntable, No. 1	1871	7—12	1·219	76	48·11	·09	4·48	52·68	44·23	·13	2·96	47·32	1060	93·47	·26	6·27	10,976	35·09	842	1320	59 16	—
Cairntable Boghead	1877	5	1·177	73	65·44	·11	1·86	67·41	27·05	·14	5·40	32·59	730	83·00	·43	16·57	14,080	41·28	991	1993	78 15	650
Cairntable splint	1876	—	1·276	79	37·19	·12	7·34	44·65	49·00	·15	6·20	55·35	1240	88·53	·27	11·20	8,550	21·88	525	641	50	510
Camp cannel	1874	8—12	1·276	79	35·19	·10	6·68	41·97	54·21	·08	3·74	58·03	1300	93·42	·14	6·44	9,050	23·82	571	739	51	540
Campbeltown cannel	1873	—	1·276	79	39·36	·06	11·25	50·67	32·56	·07	16·70	49·33	1110	66·00	·14	33·86	9,207	27·41	658	865	—	—
Canderside splint	1875	—	1·240	77	36·25	·46	7·94	44·65	50·88	·56	3·91	55·35	1240	91·93	1·01	7·06	9,020	18·84	450	580	45	452
Canderside soft coal	1873	—	1·310	82	38·21	·30	4·66	43·17	54·03	·26	2·54	56·83	1273	95·06	·46	4·48	9,462	19·49	468	632	—	—
Capledrae, No. 1	1876	27—36	1·225	77	53·66	·17	2·60	56·43	33·81	·16	9·60	43·57	976	77·60	·37	22·03	13,165	36·16	868	1632	70	618
Capledrae, No. 2	1876	9—10	1·322	82	43·40	·18	2·42	46·00	26·16	·14	27·70	54·00	1210	48·44	·26	51·30	12,210	38·46	923	1610	71	624
Chapel (Fife)	1874	10	1·224	76	43·50	·16	6·34	50·00	41·96	·14	7·90	50·00	1120	83·92	·28	15·80	11,200	34·86	836	1338	66 40	—
Chapelside (Airdrie)	1869	4	1·226	76	55·67	·14	3·32	59·13	32·97	·10	7·80	40·87	916	80·67	·25	19·08	11,272	35·61	855	1376	68 11	—
Charlesfield (Midcalder) shale	1872	—	1·744	109	29·17	1·18	1·80	32·15	6·45	1·00	60·40	67·85	1520	9·51	1·47	89·02	6,675	39·58	950	904	—	—
Clelland	1873	—	1·328	83	42·47	·60	2·26	45·33	26·06	·56	28·05	54·67	1225	47·67	1·02	51·31	11,110	33·97	815	1293	—	—
Cleugh	1869	13	1·271	79	44·36	·04	2·40	46·80	47·33	·07	5·80	53·20	1191	88·97	·13	10·90	11,450	29·39	705	1153	54	—
Climpy	1869	6	1·239	77	52·06	·89	1·10	54·05	36·02	1·23	8·60	45·95	1029	78·39	2·89	18·72	10,930	38·68	928	1449	64	—

ANALYSES OF SCOTCH COALS, CANNEL, SPLINT, SHALE, ETC. (*continued*).

Name of Coal.	Date of Analysis.	Physical Properties.			Volatile Matters.				Coke.					Coke per Cent.			Gas.					
		Thickness of Seam in Inches.	Specific Gravity.	Weight of a Cub. Foot.	Gas, Tar, &c.	Sulphur.	Water, at 212° F.	Total.	Fixed Carbon.	Sulphur.	Ash.	Total.	Pounds per Ton.	Carbon.	Sulphur.	Ash.	Cubic Feet per Ton.	Illuminating Power.	Value of a Cub. Foot in Grs. Sperm.	Sperm in lbs. per Ton.	Durability, 5-in. Flame.	Gravity.
																					Min. Sec.	
Climpy splint	1874	—	1·276	79	34·12	·12	5·50	39·74	53·44	·08	6·74	60·26	1350	88·68	·14	11·18	9,620	24·56	589	809	51	518
Cloberhill	1876	—	1·250	78	41·90	·14	4·40	46·44	51·07	·15	2·34	53·56	1200	95·35	·28	4·37	11,925	25·14	603	1027	53	514
Cobinshaw shale (curly)	1872	—	1·974	123	29·30	·77	1·18	31·25	5·15	·40	63·20	68·75	1540	7·49	·66	91·85	7,440	27·08	650	691	—	—
Craignethan	1874	11—12	1·250	78	46·27	·23	3·06	49·56	42·97	·19	7·28	50·44	1130	85·19	·38	14·43	11,661	31·62	759	1264	—	—
Crofthead (cannel and soft)	1875	—	1·250	78	37·21	·10	6·45	43·76	50·40	·09	5·75	56·24	1260	89·62	·16	10·22	10,495	25·73	617	925	53	520
Dalmacoulter	1873	3	1·244	77	47·75	·14	·78	48·67	42·37	·09	8·87	51·33	1150	82·54	·18	17·28	12,100	37·85	908	1694	—	—
Dalzell	1875	9	1·282	80	33·17	·09	7·82	41·08	52·69	·06	6·17	58·92	1320	89·43	·10	10·47	9,110	26·05	625	813	55	521
Dalzell cannel and free	1874	—	1·219	76	46·40	·16	5·68	52·24	45·28	·14	2·34	47·76	1070	94·80	·30	4·90	13,390	19·35	464	888	—	—
Drumcross	1873	—	1·429	89	42·81	1·15	2·03	45·99	26·53	·95	26·53	54·01	1210	49·12	1·76	49·12	10,335	27·47	659	973	—	—
Drumcross caking coal	1873	—	1·316	82	35·70	2·30	2·40	40·40	47·85	1.95	9·80	59·60	1335	80·29	3·27	16·44	8,875	22·13	531	673	—	—
Drumgray (upper) splint	1875	—	1·225	76	34·44	·09	9·45	43·98	52·40	·07	3·55	56·02	1255	93·54	·12	6·34	9,805	18·38	441	618	44	484
Drumpark	1870	—	1·409	88	37·59	·31	4·88	42·78	38·37	·45	18·40	57·22	1282	67·06	·78	32·16	9,813	25·53	613	859	54	—
Drumpeller splint	1874	—	1·252	78	37·51	·08	6·17	43·76	52·96	·06	3·22	56·24	1260	94·17	·11	5·72	10,018	21·97	527	754	—	—
Dryden (Loanhead)	1871	24	1·252	78	46·01	·10	6·52	52·63	42·40	·15	4·82	47·37	1061	89·50	·32	10·18	10,628	28·91	694	1054	—	—
Duntilland	1874	—	1·428	89	26·33	·52	1·72	28·57	54·95	·44	16·04	71·43	1600	76·93	·62	22·45	8,750	28·57	685	856	—	—
Dykehead (Shotts), No. 1	1874	—	1·333	83	35·78	·33	4·07	40·18	50·93	·27	8·62	59·82	1340	85·14	·45	14·41	9,243	24·79	595	785	—	—
Dykehead (Shotts), No. 2	1874	6—9	1·304	81	33·92	·32	5·50	39·74	45·73	·43	14·10	60·26	1350	75·89	·71	23·40	9,350	23·55	565	755	—	—
Dykehead (Airdrie)	1873	7—8	1·225	76	54·24	·11	·80	55·15	35·90	·05	8·90	44·85	1004	80·05	·11	19·84	12,525	40·75	978	1750	78	—
East Hermand shale (curly)	1872	—	1·639	102	33·90	·60	2·20	36·70	5·44	·36	57·50	63·30	1418	8·59	·57	90·84	7,292	34·44	826	860	—	—
Eddlewood Ell coal (soft)	1876	—	1·250	78	32·74	·05	11·42	44·21	54·30	·06	1·43	55·79	1250	97·33	·11	2·56	9,205	17·87	429	564	43	499
Fairholm	1870	8	1·269	79	38·45	·19	7·52	46·16	50·52	·28	3·04	53·84	1206	93·83	·52	5·65	9,678	22·39	537	743	52	—
Faskine	1877	—	1·225	76	48·43	·09	5·05	53·57	40·28	·10	6·05	46·43	1040	86·75	·22	13·03	11,750	37·15	891	1495	75 35	639
Faskine Bonnets	1875	3—4	1·333	83	43·26	·13	2·16	45·55	22·90	·05	31·50	54·45	1220	42·06	·09	57·85	10,360	36·37	873	1292	77 50	609
Fergushill (Kilmarnock)	1874	—	1·276	80	39·47	·18	6·47	46·12	47·56	·22	6·10	53·88	1205	88·27	·41	11·32	10,742	22·70	545	836	—	—
Fife Coal Company's cannel	1877	—	1·250	78	61·18	·16	1·34	62·68	19·66	·20	17·46	37·32	836	52·68	·54	46·78	14,060	34·10	818	1643	71	621
Firth	1872	—	1·310	82	38·85	·28	7·30	46·43	41·79	·23	11·55	53·57	1200	78·00	·43	21·57	8,901	29·67	712	905	—	—
Flemington splint	1875	31	1·304	81	37·30	·31	6·15	43·76	51·85	·25	4·14	56·24	1260	92·20	·44	7·36	9,220	17·63	423	557	44	454
Foulshiels	1875	—	1·250	78	38·71	·29	6·55	45·55	48·71	·34	5·40	54·45	1220	86·46	·62	9·92	9,445	25·97	624	842	58	542
Foxley virgin coal (soft)	1874	—	1·250	78	36·54	·35	10·44	47·33	50·28	·43	1·96	52·67	1180	95·46	·82	3·72	10,930	14·79	355	554	42	449
Gilmerton	1875	16	1·372	86	33·24	·53	6·64	40·41	38·88	·74	19·97	59·59	1335	65·25	1·24	33·51	8,190	29·49	708	830	61 35	576
Glenhead (cannel and soft)	1875	—	1·304	81	28·23	·15	10·25	38·63	51·43	·04	9·90	61·37	1375	83·80	·07	16·13	9,805	19·90	477	668	45 40	463
Greenbraes (Lesmahagow)	1868	20—22	1·212	76	51·14	·20	2·56	53·90	40·22	·22	5·66	46·10	1032	87·24	·48	12·28	12,091	30·45	731	1263	—	—
Greenhill shale	1873	—	1·480	92	37·08	·38	2·42	39·88	29·50	·32	30·30	60·12	1347	49·07	·53	50·40	9,273	34·28	822	1090	—	—
Hamperhill	1868	9—10	1·214	76	47·36	·33	4·86	52·55	41·68	·25	5·52	47·45	1063	87·84	·53	11·63	11,634	27·58	662	1100	—	—
Harthill or Polkemet (Boghead)	1875	10—12	1·186	74	58·28	·08	1·02	59·38	23·66	·06	16·90	40·62	910	58·25	·15	41·60	14,920	40·92	982	2093	87	661
Hartwood (West Calder) shale	1872	—	1·714	107	28·76	·57	2·75	32·08	6·03	·69	61·20	67·92	1521	8·88	1·01	90·11	6,360	41·53	997	906	—	—
Hartwoodhill shale	1875	10	1·430	89	38·81	·26	2·45	41·52	33·77	·31	24·40	58·48	1310	57·75	·53	41·72	9,245	35·36	848	1120	69 40	601
Hawkwoodburn	1871	—	1·379	86	39·99	·13	3·80	43·92	42·51	·23	13·34	56·08	1256	75·81	·41	23·78	9,263	28·37	681	901	58	532
Haywood	1875	8—24	1·296	80	40·66	·29	4·15	45·10	45·00	·34	9·56	54·90	1230	81·97	·62	17·41	10,415	31·75	762	1132	65	574
Head coal (Benhar)	1877	7—12	1·363	85	30·68	·62	1·30	32·60	46·32	·92	20·16	67·40	1510	68·72	1·37	29·91	8,220	36·62	875	1038	70	606
Hillhouseridge (Shotts)	1871	—	1·363	85	35·78	·36	3·04	39·18	46·44	·48	13·90	60·82	1358	76·36	·79	22·85	8,920	26·82	644	820	—	—
Hivestanks (Broxburn) shale	1872	24	1·621	101	32·09	·48	2·98	35·55	11·30	·73	52·42	64·45	1444	17·53	1·13	81·34	8,518	30·38	729	887	—	—
Holytown	1874	—	1·478	92	26·27	·69	1·16	28·12	52·19	·77	18·92	71·88	1610	72·61	1·07	26·32	8,027	23·17	556	638	—	—
Hopeton (Bathgate)	1877	10—12	1·363	85	37·96	·35	5·90	44·21	33·51	·42	21·86	55·79	1250	60·06	·76	39·68	9,650	26·39	633	873	53 35	505
Hopeton shale	1873	—	1·935	120	25·16	·26	3·15	28·57	4·33	·18	66·92	71·43	1600	6·06	·25	93·69	6,060	33·75	810	701	—	—
Johnstone caking coal	1873	10	1·428	89	32·43	1·20	4·32	37·95	37·28	1·03	23·74	62·05	1390	60·08	1·66	38·26	7,457	23·17	556	593	—	—
Johnstone shale	1873	13	1·666	104	35·42	·70	2·50	38·62	16·62	·61	44·15	61·38	1375	27·07	1·00	71·93	8,550	36·60	878	1072	—	—
Kilsyth caking coal	1876	54	1·250	78	34·37	·05	3·08	37·50	60·30	·02	2·18	62·50	1400	96·48	·03	3·49	10,427	18·55	445	663	43	453
Kiltongue (Airdrie)	1876	10	1·250	78	37·79	·34	6·07	44·20	48·28	·41	7·11	55·80	1250	86·52	·74	12·74	9,250	29·31	703	929	60	544
Kiltongue cannel, splint, and soft	1876	33	1·276	79	35·73	·32	8·16	44·21	48·27	·48	7·04	55·79	1250	86·52	·86	12·62	9,750	21·75	522	727	47	488
Kiltongue shale	1871	14	1·488	93	30·64	·05	3·53	34·22	34·54	·06	31·18	65·78	1473	52·48	·08	47·43	8,422	27·46	659	793	—	—
Kinneil	1874	11—15	1·209	75	43·08	·67	1·35	45·10	49·70	·80	4·40	54·90	1230	90·53	1·45	8·02	12,070	30·89	741	1277	66	559
Kirkmuirhill (Poneil)	1873	6	1·304	81	38·22	·15	7·40	45·77	43·94	·13	10·16	54·23	1215	81·02	·24	18·74	9,750	22·58	542	755	—	—
Kirkness (Fife)	1874	11	1·209	75	45·70	·53	4·44	50·67	36·52	·66	12·15	49·33	1105	74·03	1·34	24·63	11,875	34·81	835	1416	66 40	—
Lanemark	1869	32	1·304	81	41·69	·11	2·00	43·80	49·32	·16	6·72	56·20	1259	87·76	·28	11·96	10,480	24·56	589	882	52	—
Larkhall splint	1874	—	1·271	79	36·45	·05	7·26	43·76	54·75	·06	1·43	56·24	1260	97·35	·11	2·54	9,250	18·29	439	580	46	450

ANALYSES OF SCOTCH COALS, CANNEL, SPLINT, SHALE, ETC. (*continued*).

Name of Coal.	Date of Analysis.	Physical Properties.			Volatile Matters.				Coke.					Coke per Cent.			Gas.					
		Thickness of Seam in Inches.	Specific Gravity.	Weight of a Cub. Foot.	Gas, Tar, &c.	Sulphur.	Water, at 212° F.	Total.	Fixed Carbon.	Sulphur.	Ash.	Total.	Pounds per Ton.	Carbon.	Sulphur.	Ash.	Cubic Feet per Ton.	Illuminating Power.	Value of a Cub. Foot in Grs. Sperm.	Sperm in lbs. per Ton.	Durability, 5-in. Flame.	Gravity.
																					Min. Sec.	
Legbrannock splint	1874	—	1·250	78	34·24	·38	10·03	44·65	52·58	·32	2·45	55·35	1240	95·00	·58	4·42	9,810	22·11	530	741	—	—
Lesmahagow	1875	22	1·209	75	50·02	·10	3·45	53·57	42·28	·05	4·10	46·43	1040	91·06	·11	8·83	11,830	35·25	846	1430	67	619
Leven (Fife)	1877	—	1·316	82	47·60	·23	5·74	53·57	25·68	·30	20·45	46·43	1040	55·31	·65	44·04	12,245	30·22	725	1268	60	576
Linwood shale	1873	11	1·584	99	34·20	1·15	2·15	37·50	16·03	1·43	45·04	62·50	1400	25·65	2·29	72·06	8,575	34·79	835	1023	—	—
Linwood caking coal	1873	9	1·363	85	33·75	1·29	4·69	39·73	40·00	1·93	18·34	60·27	1350	66·37	3·20	30·43	8,823	17·05	409	515	—	—
Livingston cannel and soft coal	1873	—	1·355	84	36·81	2·60	1·98	41·39	37·36	2·13	19·12	58·61	1315	63·74	3·64	32·62	10,560	31·55	757	1142	—	—
Loanhead (Burghlee Pitt)	1876	—	1·265	79	44·71	·14	5·60	50·45	46·12	·18	3·25	49·55	1100	93·08	·36	6·56	10,260	31·27	750	1099	62	565
Lochgelly (Fife)	1875	7—24	1·219	76	37·95	·16	4·76	42·87	52·31	·18	4·64	57·13	1280	91·56	·32	8·12	10,920	24·94	598	983	50 30	507
Lochore (Fife) cannel, No. 1	1874	12	1·156	72	47·89	·21	4·58	52·68	37·00	·24	10·08	47·32	1060	78·20	·50	21·30	11,760	34·83	836	1404	71	594
Lochore Waverly cannel	1874	12	1·224	76	42·68	·09	5·45	48·22	31·89	·09	19·80	51·78	1160	61·59	·17	38·24	11,145	33·09	794	1264	67	597
Lochore "Spratts"	1874	3—8	1·304	81	37·83	·55	6·50	44·88	31·34	·68	23·10	55·12	1235	56·86	1·23	41·91	10,290	25·96	623	916	56	532
Longford cannel or shale	1874	—	1·463	91	33·52	·14	3·84	37·50	35·12	·18	27·20	62·50	1400	56·19	·29	43·52	6,430	30·59	734	674	60 45	587
Longford splint	1874	—	1·304	81	35·83	·33	7·16	43·32	50·02	·40	6·26	56·68	1270	88·25	·70	11·05	8,490	18·66	448	543	48	486
Longlee	1874	—	1·228	76	40·26	·10	6·08	46·44	47·37	·09	6·10	53·56	1200	88·44	·17	11·39	9,750	31·13	747	1040	62 30	—
Longrigg shale	1874	3—5	1·500	93	34·21	·88	1·51	36·60	28·54	1·12	33·74	63·40	1420	45·02	1·26	53·22	9,020	32·73	785	1012	62 30	602
Lumphinans (Fife) soft coal	1872	60	1·319	82	39·83	trace.	3·11	42·94	55·39	trace.	1·67	57·06	1278	97·07	trace.	2·93	11,880	15·43	370	628	—	—
Mainhill	1877	12—20	1·304	81	33·75	·16	4·85	43·76	46·69	·15	9·40	56·24	1260	83·02	·27	16·71	11,125	29·07	697	1108	58	519
Maryville (Baillieston)	1875	—	1·250	78	37·85	·18	9·30	47·33	48·18	·15	4·34	52·67	1180	91·47	·29	8·24	10,095	22·90	550	793	50	495
Maybole main seam dross	1875	—	1·225	76	32·23	·11	6·95	39·29	57·38	·08	3·25	60·71	1360	94·52	·13	5·35	9,015	23·52	564	726	52	505
Merryton	1872	—	1·260	79	33·06	·05	9·75	42·88	52·86	·03	4·23	57·12	1279	92·54	·05	7·41	9,105	22·59	506	658	—	—
Milnwood	1872	5	1·276	80	41·94	·11	5·20	47·25	45·06	·15	7·54	52·75	1182	85·41	·29	14·30	10,173	25·58	614	892	—	—
Milnwood (Lesmahagow)	1868	6—9	1·216	76	47·84	·25	4·11	52·20	43·16	·28	4·36	47·80	1071	90·30	·58	9·12	12,578	30·18	724	1301	—	—
Milton (Fife)	1874	9—15	1·250	78	46·61	·33	5·52	52·46	36·86	·26	10·42	47·54	1065	77·53	·55	21·92	10,168	35·34	848	1232	—	—
Mingle	1877	11	1·276	80	41·14	·53	·98	42·65	51·23	·64	5·48	57·35	1285	89·33	1·12	9·55	10,390	29·54	709	1052	61	565
Monkland	1876	4—5	1·215	76	47·81	·13	3·85	51·79	41·40	·16	6·65	48·21	1080	85·88	·33	13·79	10,825	36·17	868	1344	74	608
Monkland soft coal	1875	—	1·240	77	31·72	·06	8·40	40·18	58·54	trace.	1·28	59·82	1340	97·86	trace	2·14	9,100	15·74	378	491	42	458
Monkland "Bonnets"	1875	—	1·534	95	28·93	·07	3·15	32·15	34·61	·04	33·20	67·85	1520	51·01	·06	48·93	8,480	31·06	745	902	62 30	541
Morningside	1877	—	1·271	79	34·56	·14	9·06	43·76	51·92	·16	4·16	56·24	1260	92·32	·29	7·39	10,295	21·43	514	756	47	460
Muirkirk, No. 1	1871	13—22	1·230	77	50·71	trace.	2·20	52·91	44·57	trace.	2·50	47·09	1054	94·69	trace	5·31	11,380	33·88	813	1321	62	—
Muirkirk, No. 2	1871	—	1·265	79	48·78	·09	2·60	51·47	42·94	·13	5·46	48·53	1087	88·48	·27	11·25	10,678	32·77	786	1199	61	—
Nettlehole	1875	—	1·333	83	35·94	·18	5·40	41·52	43·35	·23	14·90	58·48	1310	74·13	·39	25·48	9,370	26·18	628	840	55 35	514
Newbattle	1875	13	1·225	77	47·16	·48	4·15	51·79	42·94	·57	4·70	48·21	1080	89·07	1·18	9·75	11,430	31·67	760	1241	69 35	574
New Park	1872	—	1·209	75	46·99	·11	3·85	50·95	42·77	·08	6·20	49·05	1100	87·20	·16	12·64	11,143	34·66	831	1332	—	—
Niddrie, No. 1	1874	20—36	1·255	78	45·30	·20	4·72	50·22	45·75	·17	3·86	49·78	1115	91·91	·34	7·75	11,360	30·23	725	1176	60	—
Niddrie, No. 2	1874	10—15	1·268	79	44·72	·33	4·36	49·41	43·71	·38	6·50	50·59	1133	86·40	·75	12·85	11,355	27·96	671	1088	61	—
Niddrie, No. 3	1874	32	1·290	80	35·65	·22	7·45	43·32	51·26	·18	5·24	56·68	1270	90·44	·32	9·24	9,090	25·47	611	793	55	552
Niddrie blue coal	1875	—	1·219	76	44·76	·29	5·40	50·45	46·80	·35	2·40	49·55	1110	94·45	·71	4·84	11,640	22·72	545	906	53	541
Niddrie great seam splint	1875	24	1·316	82	34·65	·06	9·05	43·76	51·46	·03	4·75	56·24	1260	91·48	·06	8·46	9,050	17·95	431	557	46	497
Niddrie head coal (splinty cannel)	1875	6—7	1·363	85	34·36	·08	4·85	39·29	49·89	·07	10·75	60·71	1360	82·18	·11	17·71	10,180	20·11	482	701	46 35	471
Niddrie south parrot (splinty)	1875	14—18	1·250	78	37·90	·11	6·20	44·21	50·78	·10	4·91	55·79	1250	91·02	·18	8·80	9,150	24·25	582	761	52	526
Niddrie Stairhead cannel	1875	16	1·395	87	36·01	·20	7·55	43·76	48·44	·22	7·58	56·24	1260	86·13	·39	13·48	9,170	20·92	502	657	50	495
Niddrie Stairhead splint	1875	31	1·293	81	32·95	·12	9·35	42·42	54·25	·08	3·25	57·58	1290	94·21	·14	5·65	9,025	16·62	399	514	45	483
North Green (Gilmerton)	1876	7—10	1·276	80	38·79	·35	7·30	46·44	43·15	·51	9·90	53·56	1200	80·56	·95	18·49	10,065	24·36	584	840	49	510
North Linrig soft coal	1873	—	1·305	81	35·82	·13	6·92	42·87	55·11	·16	1·86	57·13	1290	96·46	·28	3·26	9,080	16·04	385	539	—	—
Old Wemyss	1875	27	1·250	78	46·69	·30	2·86	49·85	35·96	·39	13·80	50·15	1133	71·70	·78	27·52	11,720	34·92	838	1403	71 25	616
Orchard (Lesmahagow)	1874	10½	1·224	76	46·72	·05	3·68	50·45	43·67	·03	5·85	49·55	1110	88·13	·06	11·81	12,525	33·52	804	1438	68	612
Pathhead (New Cumnock)	1871	18—24	1·532	95	40·87	·25	3·88	45·00	32·25	·37	22·38	55·00	1232	58·64	·67	40·69	9,695	28·23	677	928	—	—
Pollok	1869	8	1·234	77	46·72	·08	1·40	48·20	49·19	·11	2·50	51·80	1160	94·97	·21	4·82	11,525	30·26	726	1195	58	—
Poniel	1872	8	1·277	80	41·26	·10	6·52	47·88	44·90	·12	7·10	52·12	1167	86·15	·23	13·62	10,126	23·18	556	804	—	—
Pool (Haywood)	1877	—	1·363	85	41·81	·40	2·44	44·65	36·12	·47	18·76	55·35	1240	65·26	·85	33·89	11,030	30·51	732	1153	61	550
Provanhall	1871	24	1·296	81	39·68	·16	4·36	44·20	45·95	·25	9·60	55·80	1250	82·35	·45	17·20	9,380	26·52	636	853	53	—
Raploch	1877	9	1·276	79	34·11	·15	9·06	43·32	53·05	·19	3·44	56·68	1270	93·60	·33	6·07	9,980	22·05	532	758	48	490
Rawyards (Airdrie)	1875	4	1·209	75	52·53	·07	1·65	54·25	39·80	·05	6·80	45·75	1025	85·03	·11	14·86	12,400	39·04	937	1660	79	667
Rawyards splint	1876	—	1·276	80	34·81	·08	3·73	38·62	56·90	·11	4·37	61·38	1375	92·70	·18	7·12	9,945	21·53	516	733	52	508
Redhouse (Bathgate) caking	1874	—	1·288	80	30·47	·19	9·74	40·40	51·72	·20	7·68	59·60	1335	86·78	·33	12·89	7,850	18·88	453	508	46	502
Rigside	1877	21	1·304	81	43·07	·66	3·60	47·33	36·25	1·00	15·42	52·67	1180	68·82	1·90	29·28	11,820	32·32	775	1309	66	547
Rochsoles shale	1872	9	1·515	94	38·19	·14	1·15	39·48	17·06	·08	43·38	60·52	1355	71·68	·13	28·19	8,748	34·67	832	1039	—	—
Rochsolloch	1868	3	1·196	75	49·98	·18	3·20	53·36	41·18	·06	5·40	46·64	1045	88·29	·13	11·58	10,518	32·30	775	1164	65	—
Rosehall	1872	—	1·333	83	37·27	·30	4·60	42·17	47·38	·25	10·20	57·83	1295	81·93	·43	17·64	9,781	22·40	538	751	—	—
Roslin	1875	—	1·214	76	43·00	·09	8·25	51.34	42·18	·08	6·40	48·66	1090	86·69	·16	13·15	11,410	27·72	665	1084	55	549

ANALYSES OF SCOTCH COALS, CANNEL, SPLINT, SHALE, ETC. (*concluded*).

Name of Coal.	Date of Analysis.	Physical Properties.			Volatile Matters.			Coke.				Coke per Cent.			Gas.				
		Thickness of Seam in Inches.	Specific Gravity.	Weight of a Cub. Foot.	Gas, Tar, &c.	Sulphur.	Water, at 212° F.	Total.	Fixed Carbon.	Sulphur.	Ash.	Total.	Pounds per Ton.	Carbon.	Sulphur.	Ash.	Cubic Feet per Ton.	Illuminating Power.	Value of a Cub. Foot in Grs. Sperm.	Sperm in lbs. per Ton.	Durability, 5-in. Flame.	Gravity.
																					Min. Sec.	
Shields	1869	20	1·263	85	37·40	·15	4·30	41·85	49·92	·23	9·00	58·15	1302	84·13	·40	15·47	10,705	21·22	509	778	—	—
Shields main cannel	1871	—	1·250	78	49·39	·16	8·60	49·35	46·00	·25	4·40	50·65	1134	90·81	·50	8·69	10,559	24·51	588	897	—	—
Spindleside	1871	7	1·505	94	30·21	·59	2·16	32·96	29·31	·69	31·84	61·04	1367	46·38	1·46	52·16	6,800	35·45	851	827	—	—
Stane, No. 3	1874	4	1·505	81	31·04	·86	5·15	37·05	54·57	1·05	7·33	62·95	1410	80·69	1·67	11·64	7,095	25·12	603	611	56 40	—
Stockwell	1868	10	1·233	77	49·64	·40	3·28	52·32	38·77	·51	8·40	47·68	1068	81·75	·65	17·60	12,450	31·10	745	1327	61	568
Tannochside splint	1872	—	1·266	79	36·50	·15	6·20	42·85	53·15	·22	3·78	57·15	1308	93·00	·38	6·62	9,197	20·02	480	630	—	—
Thrashbush (Airdrie)	1876	5	1·181	74	53·68	·15	1·53	55·36	37·54	·14	6·96	44·64	1000	84·10	·31	15·59	12,520	39·51	946	1696	77	625
Trees (Bathgate)	1873	—	1·430	87	32·73	·16	5·83	38·72	36·67	·11	24·50	61·28	1372	59·64	·18	39·93	7,862	26·02	624	701	—	—
Watson's Hartley	1873	—	1·310	82	35·99	·20	5·78	41·97	52·27	·13	5·63	58·03	1300	90·08	·22	9·70	9,820	24·16	580	814	—	—
Waulkmill	1876	—	1·225	77	41·48	·16	4·36	46·00	46·00	·20	7·80	54·00	1210	85·18	·37	14·45	10,320	30·54	733	1080	61	594
Wee Lesmahagow	1870	8	1·253	78	48·43	·07	4·30	52·80	44·13	·09	2·98	47·20	1057	93·53	·19	6·28	12,620	32·30	775	1386	64	598
Westwood and Langbyres shale	1875	—	1·363	85	40·72	·33	2·27	43·32	21·27	·51	34·90	56·68	1270	37·53	·90	61·57	10,070	34·89	897	1204	74	601
Westwood splint	1875	—	1·250	78	32·89	·42	10·90	44·21	52·93	·53	2·33	55·79	1250	94·87	·95	4·18	10,160	18·53	445	646	46 25	498
Westwood shale (W. Calder)	1872	—	1·622	101	34·27	·73	3·20	38·25	5·80	·60	55·95	61·75	1383	8·58	·97	90·45	7,160	27·88	669	694	—	—
Westwood shale, No. 2	1872	—	1·975	123	27·94	·53	2·95	31·42	3·73	·30	64·55	68·58	1536	5·44	·44	94·12	7,065	34·37	895	833	—	—
Westwood shale, No. 3	1872	—	1·875	117	20·43	·70	6·35	27·53	12·75	·67	59·05	72·47	1623	17·60	·92	81·48	3,900	27·49	660	368	—	—
Wilsontown	1869	9	1·253	79	42·20	·12	3·38	45·70	47·69	·17	6·44	54·30	1216	87·82	·32	11·86	10,538	33·20	796	1198	59	547
Wilsontown splint and cannel	1872	—	1·250	78	34·64	·03	7·24	41·96	46·80	·04	11·20	58·04	1300	80·63	·07	19·30	8,676	29·16	698	—	—	—
Wilsontown main coal (mixed)	1872	—	1·271	79	32·43	·09	10·75	43·32	52·40	·08	4·20	56·68	1270	92·45	·14	7·41	9,635	22·92	550	757	—	—
Woodmuir cannel	1874	9	1·764	110	30·00	·17	3·22	33·48	17·78	·14	48·60	66·52	1490	26·73	·21	73·06	7,975	27·12	651	741	—	—
Woodmuir free coal	1874	—	1·304	81	35·38	·24	5·90	41·52	54·53	·40	3·55	58·48	1400	93·24	·69	6·07	9,025	24·14	579	746	—	—
Woodside	1877	5—8	1·276	80	42·04	·34	7·85	50·23	44·55	·42	4·80	49·77	1115	89·51	·84	9·65	10,790	27·38	657	1013	34 35	530
Wyndedge	1874	—	1·364	85	41·47	·53	2·65	44·65	24·36	·46	30·53	55·35	1240	44·01	·83	55·16	10,390	32·43	778	1155	58	582

Legal Intelligence.

HOUSE OF LORDS.—THURSDAY, DEC. 13.

(*Before the* LORD CHANCELLOR, *Lord* BLACKBURN, *and Lord* GORDON.)

PATTERSON *v.* THE GASLIGHT AND COKE COMPANY.

This was an appeal from Her Majesty's Court of Appeal, and was heard on the 7th, 8th, and 14th of November last, the plaintiff, who is the appellant, conducting his own case, and Mr. SOUTHGATE, Q.C., Sir HENRY JAMES, Q.C., Mr. DAVEY, Q.C., and Mr. STIRLING (instructed by Messrs. Curtis and Bedford) appearing for the respondents.

The case first came before Vice-Chancellor Bacon in December, 1875, in a suit in which the plaintiff sought to restrain The Gaslight and Coke Company from infringing a patent taken out by him in March, 1872, for improvements in the mode of purifying coal gas. After arguments and evidence extending over seventeen days, the Vice-Chancellor gave judgment for the plaintiff, granting an injunction against the company, and awarding him such damages for their unlawful use of his invention as upon inquiry might be deemed right. His honour also granted a certificate under the Act as to the validity of the plaintiff's patent. Against this decision The Gaslight and Coke Company appealed, and the case was heard before Lord Justice James, Lord Justice Baggallay, and Justice Lush, in May, 1876, the arguments extending over three days, the result being that the Lords Justices of Appeal reversed the decision of the Court below, and dismissed the plaintiff's Bill with costs, including the costs of the appeal. Against this judgment the plaintiff now appealed, and occupied three days in laying his case before their lordships, dealing, however, only with the first two claims made by him in the specification of his letters patent. The Lord Chancellor then intimated that the appellant need not proceed further at that time, and that they would communicate with the parties if, in the opinion of their lordships, it was necessary to hear the respondents.

The arguments on both sides have been so fully reported in the JOURNAL during the various stages of the proceedings, and the facts are so clearly stated in the judgment now delivered by their lordships, that it is quite unnecessary to give even an outline of the statements of the appellant.

JUDGMENT.

Lord BLACKBURN: My lords, in this case the appellant, on March 9, 1872, petitioned for a patent for improvements in the purification of coal gas, and on that day filed his provisional specification. The letters patent were dated on that day. On Sept. 9, 1872, he filed a complete specification, in which he made five claims—the first and second relating to purifying gas by means of lime purifiers, whereby the contents of the purifiers, or some of them, were converted into sulphide of calcium; the third, fourth, and fifth heads of claim relating to processes in which lime was not employed. It was not denied that if the plaintiff's patent was new, the defendants had done what would amount to an infringement of the patent; but it was alleged by the defendants that each one of the five claims of the plaintiff was not the subject of a valid patent, on the ground that the subject matter of the claim was already known to the public; and if this is made out on the evidence as to any one of the five claims, then, there being no disclaimer, the whole of the patent is void. The consideration of each of these five claims in the specification requires it to be determined what the fact is, and what was proved to have been known before the date of the letters patent—namely, March 9, 1872. The Vice-Chancellor, in the Court below, came to the conclusion that no one of those five objections was established, either in fact or in law. The Court of Appeal came to the conclusion that each one of the objections—any one of which, if made out, would be fatal to the validity of the patent—were all established, but besides those five objections which required determination on a consideration of the disputed facts, there was another point in which the facts were undisputed, and which was only a point of law. The appellant was one of three Gas Referees appointed under the City of London Gas Act, 1868. These Gas Referees had, on Jan. 31, 1872—that being previous to the date of the patent, which was March 9, 1872—drawn up a report to be presented to the Board of Trade. This report was then agreed to by all three, and all that was in it must then have been known to both the other Referees as completely as it was known to the appellant. The report, though then complete, was not sent in to the Board of Trade until the 26th of March, nor received by the Board of Trade until the 27th of March, when it was without any delay circulated amongst the gas companies by the Board of Trade, and was the subject of much discussion, and its contents were known to all concerned in gas manufacture. It was not disputed that part of what was claimed as a novelty in the specification of March 9, 1872, is also to be found in this report, which is dated Jan. 31, 1872. The appellant, in paragraph 37 of his amended bill of complaint, says: "On March 26, 1872, a report to the Lords of the Committee of the Privy Council for Trade was forwarded to the Board of Trade by the Metropolitan Gas Referees (of whom the plaintiff was one) 'On the Sulphur Purification at the Beckton Gas-Works,' in which the defects in the purifying processes and apparatus at the Beckton works were pointed out, and also wherein one of the methods of employing the plaintiff's invention described in the aforesaid specification of the plaintiff—*videlicet*, that relating to the working of lime purifiers—was, with the plaintiff's assent, clearly indicated or described." The Vice-Chancellor seems to have treated this as being merely a personal objection to the appellant. The Court of Appeal, in their judgment, have stated *primâ facie* that, in their view of the other points of the case, it was not necessary to pronounce any final decision on this point, and that showed very clearly that this was not in their view the real nature of the objection, but they thought it very questionable whether it was competent for the plaintiff to take out a patent for this. In their judgment they also said: "The suggestion that the report was kept back for the purpose of enabling one of the Referees to apply for a patent is not entitled to much favour. It is to be borne in mind that the report when made belonged absolutely to the State. Every fact and figure in it had been ascertained and obtained at the public expense. Every hour of every Referee and of the secretary employed in the production of it was public time. It was, of course, printed at the public cost. The withholding or wilful delaying of it was a plain breach of public duty, and it is difficult to see how the plaintiff can be in a better position than if he and his colleagues had done their duty, and duly presented their report as soon as it was completed. The consideration for every patent is the communication of useful information to the public. What consideration is there when the information was already the property of the State?" My lords, the plaintiff has been, unfortunately, reduced to poverty, and was obliged to conduct his case in person at your lordships bar. It could not be expected that he should deal with questions of law as a trained lawyer would have done, and although he was thoroughly acquainted with all the facts of the case, and understood the evidence given in its details, and was as well able to conduct the case on that part of it as any counsel who could have been employed, he could not be expected to bring the facts before your lordships House as well and pointedly as a trained counsel would have done. Great allowance should be made, my lords (and I am sure was made by each of your lordships), for the appellant upon that account. After hearing all that he had to say on the questions as to the first and second claims of his specifica-

tions, and on the question of the report being dated before the date of the patent, your lordships were disposed to think that the judgment of the Court of Appeal ought to be affirmed on the ground that the first two claims of the patent were not new; and your lordships adjourned the consideration of the case without hearing the contention of the appellant on the other three claims, and without hearing the respondents counsel in answer to the argument as far as it had gone, which would be unnecessary if your lordships should still be of the same opinion as you were then inclined to be. If any doubt arose in the minds of your lordships the argument was to be resumed. My lords, after carefully reading the appellant's case (in the preparation of which he had the assistance of counsel), and after considering the arguments, and the judgment of the Vice-Chancellor, I have come to the conclusion that the judgment of the Court of Appeal should be affirmed on both of the two grounds which they based their judgment upon—namely, that the first two claims of the specification are proved to have been known to the public, and also to have been used by the public before the date of the specification; and also on the ground mentioned in the judgment (which was not made the subject of final determination), that the whole of what was contained in the report was public property before the report was sent in to the Board of Trade, and that consequently, from the time the report was framed—viz., on Jan. 31, 1872, at the latest—there was no consideration for a patent, because it had ceased to be a new manufacture before the date of the patent. My lords, I think it more convenient to deal with this last question first, and, in order to make it intelligible, it is necessary to state the position of the Gas Referees, and the state of knowledge at that period. My lords, crude or raw gas exists in the retorts with certain impurities, many of which are got rid of in the scrubbers, which it is not material for your lordships to consider; but, passing from the scrubbers, the gas still contains more or less impurities, including amongst them carbonic acid, sulphuretted hydrogen, and sulphur existing in other forms than sulphuretted hydrogen. This latter form of impurity consists principally of bisulphide of carbon, and it does not appear at present whether or not there are other forms of sulphur in those sulphur compounds. Before 1850 this purification was effected by passing it through successive purifiers charged with lime, which were kept in action until the first of the purifiers became foul—that is, saturated with sulphuretted hydrogen. By this process the sulphuretted hydrogen was removed, but the removal of it, of course, was not the object of those who used the process at this time, but it was designed to remove the carbonic acid; and at this time lime was used for the purpose of removing carbonic acid and sulphuretted hydrogen. The bisulphide of carbon was also removed, as it was acted on to some extent by the lime, which formed sulphide of calcium, which has the property of removing bisulphide of carbon, as it exists in ordinary gas. So long, therefore, as this process was used to remove the sulphuretted hydrogen from the gas, it also removed to a great extent the sulphur, in other forms than sulphuretted hydrogen, the contents of the purifiers as thrown out consisting of foul lime—that is, partly of carbonate of lime, and partly of sulphide of calcium. The use of this was always objected to in towns, as lime created a nuisance. About 1850 the process of passing the gas through oxide of iron was brought into use. Oxide of iron also has no effect on carbonic acid or bisulphide of carbon; therefore, the fact of using it for the purpose of taking out sulphuretted hydrogen alone, left in the gas all the other forms of sulphur than sulphuretted hydrogen, and at this time there were great complaints that the gas did contain too much sulphur in other forms than sulphuretted hydrogen. The Metropolis Gas Act of 1860, by section 25, requires the company, under penalties, to supply gas which should not contain more than 20 grains of sulphur per 100 cubic feet, but the gas companies in the City alleged that it was not the fact that they were able to supply gas free from sulphur in other forms than sulphuretted hydrogen. By the City of London Gas Act they were relieved from this, and powers were given to appoint Referees, whose powers are defined by the 33rd, 34th, 35th, and 36th sections of that Act. The 36th section, which is the one which is most material for this case, is in the following terms:—"The Gas Referees shall from time to time ascertain with what degree of purity each company can reasonably be required to make and supply gas continuously without occasioning a nuisance to the neighbourhood in which the works are situate, and shall thereupon prescribe and certify the maximum amount of impurity in each form with which gas supplied by the company shall be allowed to be charged, and the time from which the allowance thereof shall be enforced as against each company, regard being had to the necessity for any alteration of works by a company, consequent on any such certificate." My lords, it seems to me that it was clearly the duty of the Referees, under this section, to ascertain how far the gas could be practically purified by each company. If they found gas not containing more than a certain amount of impurity, they were to prescribe the maximum amount accordingly; and they were, by obvious implication, although not expressly, to make public how this impurity was to be removed. It was not material to them to inquire whether those were means previously known which the companies had failed to make use of, or whether there was some new idea which had been developed during the course of the inquiry which made these old means practically available. They were not at all required to distinguish the new from the old, but, as soon as they became aware that the gas could be brought to this degree of purity, their duty was to fix the maximum, and to make known to the public the means by which it could be purified to this extent. My lords, the report of Jan. 31, 1872, shows it all. It shows that some means had been employed; it makes no attempt to show how much of this was previously known, and it nowhere states that any part of what was known was invented by one of them. The object of the specification of Sept. 9, 1872, was quite different. It was required to describe and ascertain the nature of the appellant's invention, and in what manner it was to be used or carried into effect. The consideration for a patent is the information communicated to the public. In "Hindmarch on Patents," at page 33, it is laid down, "If the public once becomes possessed of an invention by any means whatever, no subsequent patent for it can be granted either to the true and first inventor himself, or any other person, for the public cannot be deprived of the right to use the invention, and a patentee of the invention could not give any consideration to the public for the grant, the public already possessing everything that he could give." This is, in my opinion, a correct statement of the law. It is not necessary that an invention should be used by the public as well as known. If an invention, and the mode in which it had been used, had been made known to the public by a description in a work which has been publicly circulated—as in *Stead v. Williams*, in the 7th Manning and Granger; in *Bush v. Fox*, 5th House of Lords; and in *Betts v. Menzies*, 10th House of Lords—it avoids the patent which has not been in use. It is true an antecedent specification ought not to be held to be an anticipation of a patent, unless you think that that antecedent specification discloses a practical mode, which has the effect of accomplishing the same result as the subsequent discovery does; but all this is removed in this case by the statement in the 37th paragraph of the plaintiff's bill. If the date of the report had been after the date of the patent, the case upon this would, it seems to me, have been quite unarguable. The date of the patent was, however, before the contents of the report were known to the gas companies, though several weeks after they were known to the whole of the Gas Referees and their secretary; and, as I have already pointed out, the moment the Referees became aware of what was stated in the report, it became the property of the public. The appellant contends that it was known to the Referees only confidentially. I do not pause to inquire whether that was a fact, for I think it immaterial. I do not mean to throw any doubt on the doctrine of *Morgan v. Seward*, in the 2nd Meeson and Welsby, that a disclosure of the circumstances under which the patent was taken out to a person under an obligation to keep it secret is not a disclosure to the public, if such persons could not have made known the disclosure without a breach of duty. In this case, the present public officers could not keep it secret without a breach of duty. They were bound to make it known, and even if they, in breach of their duty, kept it back, the invention was no less the property of the public from the time the Referees knew it. I have only further to observe that this view of the case does not appear to have been brought to the notice of the Vice-Chancellor. He treats this ground of objection as if it were one personal to the appellant, in his personal capacity. My lords, if the Attorney-General had replied to this objection on this ground, and claimed to have the patent rescinded by the Crown on that ground, it would have been necessary to consider how far this was made out. As it is, all that it is necessary to say is, that this point is not raised. My lords, I have also come to the conclusion that that portion of what the appellant claims as a new invention, as described in the claim of the specification in which he describes his process, down to the words "sulphides of calcium," had been done at the works at Bow prior to the date of the patent. A description of what had been done at the Bow works from 1867 downwards will be found in the affidavit of Mr. Harris, who says: "The gas, on leaving the hydraulic mains, passes through condensers, where the tar and vapour of the water are deposited in a liquid form by the cooling action of the atmosphere. From the condensers it passes through scrubbers, where the ammonia and part of the sulphuretted hydrogen and carbonic acid are arrested by the gas being brought into contact with the gas liquor, previously deposited in the condensers, and also with clean water which is used in the scrubbers. From the scrubbers it passes through two purifiers, each charged with (originally clean) slaked lime. The chemical action that takes place is—first, the clean lime absorbs the sulphuretted hydrogen, and sulphide of calcium is formed, which in its turn absorbs the other sulphur compounds; secondly, the sulpide of calcium is broken up by the carbonic acid, and the lime is converted into carbonate of lime, which does not act on the sulphur compounds. When the power of the sulphide of calcium for absorbing the sulphur compounds begins to decrease (which is ascertained by the sulphur test experiment) a fresh purifier of clean lime is put to work, which at once produces a fresh supply of sulphide of calcium. At the same time the first of the original two purifiers is thrown out of action, and the lime, now nearly all carbonate, is removed and replaced by clean lime, ready for further action when required, the same operation being performed with each one in continuous succession. From the lime purifiers the gas passes through three purifiers, each charged with oxide of iron, where the remaining impurity—sulphuretted hydrogen—is removed." Some confusion was introduced into the cross-examination as to when the system of testing was first commenced at the Bow works; but it does not seem to me to be worth while to try to clear it up; for assuming the testing was not used at first, it is clear that the testing was done long before 1872. Mr. Stephen Carpenter, the manager of the works, says, on cross-examination, that he learnt by practical experience that when 7 million cubic feet of gas, of such purity as that which comes from the scrubbers, had passed through the purifiers at Bow, it was time to remove the first purifier, and to make the second purfier first, and bring a new one into operation, and that this had been done. Now this testimony is uncontradicted. It may, however, be observed that in the specification it is said that after the testings for carbonic acid and sulphuretted hydrogen had been made for a short time, the engineer will be able to ascertain the quantity of this new substance in his purifier with sufficient accuracy, by merely noting the quantity of gas passing through each purifier without testing. The appellant, from what he says in the 7th paragraph of his specification, seems to be of opinion that even if he had first discovered only the reason for, or the theory of, what had before been done (which had only been done empirically), it is the subject of a claim for a patent. I need hardly point out that that is a mistake. Any person who, knowing the theory, takes out a patent to make certain improvements, cannot prevent other people from doing what they had done before. The fact is that Dr. Letheby had, in the lecture delivered in 1870, stated what had been done at the Bow works; and not only had he stated what was thus done, but also the chemical rule on which it was based. And in speaking of these works at Bow, he had before said that this was the result of the operation of the sulphuretted hydrogen on the dry lime, converting it into sulphide of calcium. Dr. Letheby says in that lecture, in 1870, "In the case of sulphide of calcium, it should be permitted to act for some time after the lime has become foul, for it is in this condition that it is most effective; and a lime purifier should not be changed until the sulphuretted hydrogen of the foul lime is largely displaced by the carbonic acid of the raw gas." My lords, I will not occupy more time by pointing out in detail what seems to be obvious—namely, that the two first claims in the specification are such that he cannot prevent any one from doing that which Mr. Harris and Mr. Carpenter say they did in 1867, and what Dr. Letheby, in 1870, said they were then doing, and in which document he explained the effect. There was a great deal of other evidence (especially as to the Beckton works) to explain the effect of the working in 1872; but as what I have before referred to is quite sufficient to show that the appellant's invention is not sufficiently described, it seems to me, for each of these reasons, that the judgment of the Appeal Court should be affirmed. I have therefore, my lords, to move that the judgment of the Court of Appeal be affirmed. In any ordinary case the motion would be that the appeal should be dismissed with costs; but I believe the appellant is *in formâ pauperis*, and consequently it will not be dismissed with costs, but the motion will be simply that it should be dismissed.

The Lord Chancellor: My lords, I had prepared in this case some observations which I proposed to make to your lordships on the question raised by this appeal, and I intended to have submitted to your lordships a motion exactly the same as that which my noble and learned friend has proposed, but having had the advantage of seeing and considering the reasons which he has given, I have found that all that I desired to express to your lordships has been so fully and so clearly expressed by my noble and learned friend, that I do not propose to do more than say that I entirely concur in the reasoning which he has adopted. My lords, to that I must make one exception. I desire to say that I entertain the very strongest opinion that, looking to the position of the appellant in this case, as one of the Referees under the Act of Parliament, I hold it to be perfectly impossible that there should have been inserted in the report of the Referees, prepared and put in type, and dated on Jan. 31, 1872, a statement of a process adopted for the purification of gas, and that that could

have been done without the public becoming the absolute proprietors of the statement, and of any novelty, if there was any novelty, in the invention which was so described. My lords, I observe that in this particular case one of the Referees has made an affidavit. I have not observed any reason, indeed, why the other Referee has not given any evidence; but the Referee who has made an affidavit has stated that the communication by the appellant to the Referees was confidential, and that it was *understood* (that is the word used by him) that he was to be at liberty to take out a patent; that, he says, was their *understanding*. My lords, I should not be able, if the question of fact were material, to accept a statement made in that way by one of the Referees, as proof of the fact that there had been a confidential communication of this process, or that there had been any agreement distinctly made by the parties as to the right of the appellant subsequently to take out a patent. But, my lords, however the question of fact may be—whether anything was said between the parties or not—I hold, in the strongest way, that it was entirely *ultra vires* on their part to accept a statement which was to be introduced into their report, and to agree in the fact that the process described in their report would be a useful process for the purpose of purifying gas, and yet to have coupled that with any agreement on their part that the statement was to be confidential, or that there was to be any right on his part to take out a patent. It was a communication made to them in the discharge of their duty as public officers. The moment it was made to them, it became public property; and it was not in their power to withhold in any way from the public the full benefit of that communication. My lords, I have made that observation on the assumption, and it is only on the assumption, that there was in that statement in the report something that was new; but I am not satisfied, by any means, that there was anything that was new in the statement so introduced into the report, and I should require nothing more to prevent my being satisfied that that was so than the statement which I find under the hand of the appellant in this case in one of his letters, and that is the only additional observation which I desire to make to your lordships. My lords, the report to which I have referred was in type and was dated Jan. 31, 1872. The provisional specification of the patent on which the appellant relies was dated on March 9 in the same year. The report, which is dated the 31st of January, was sent in to the Board of Trade on the 26th of March, and on the 27th of March, 1872, the appellant wrote this letter to one of the officials—to one of the servants of the company of the respondents:—"My dear Phillips,—We sent in our report late yesterday afternoon, because we could not keep it back any longer. Have you got Odling's or Letheby's reports? Odling called here, and I told him that we had a report in print. Foster is out"—he was the secretary of the Referees, I believe—"Foster is out, and the copies locked up"—that is to say, that the copies of the report which had been sent in to the Board of Trade were locked up—"but I will send you one to-morrow." Now the letter ends with this sentence:—"All the suggestions in the report have been communicated to Trewby and others months ago." This letter, my lords, is written on March 27; the provisional specification is on March 9—not three weeks previously; and there is this statement under the hand of the appellant, that all the suggestions in the report had been made known to Trewby and others months before. My lords, it seems to me perfectly impossible, after those facts have been stated, that the appellant can maintain any claim to this invention as a novelty on March 9, 1872. I quite agree with the motion that my noble and learned friend has made, that the appeal should be dismissed.

Lord Gordon: My lords, I also agree in the motion which has been made. This case is very voluminous, but the points which are raised for the decision of the House, and which are required to be considered by your lordships, are very few, and are both of considerable importance and attended with much difficulty. The appellant was one of three Gas Referees appointed by the Board of Trade under the City of London Gas Act, 1868, the 36th section of which Act provides that the Gas Referees should "from time to time ascertain with what degree of purity each company can reasonably be required to make and supply gas continuously without occasioning a nuisance to the neighbourhood in which the works are situated, and shall thereupon prescribe and certify the maximum amount of impurity in each form with which gas supplied by the company shall be allowed to be charged, and the time from which such allowance thereof shall be enforced as against each company, regard being had to the necessity for any alteration of works by a company, consequent on any such certificate." It was the duty of the Referees, in virtue of this provision, to make themselves acquainted with the mode of manufacture of gas adopted by each company, and to ascertain how far this manufacture could be improved by the gas purification. It was their duty to give all the assistance which their particular knowledge enabled them to give in order to arrive at this result. Facilities were given to the Gas Referees for experimentalizing, and it is in evidence that many experiments were made by the companies at the desire of, and in the presence of, the Referees. In this way the Referees obtained information as to the mode of improving the purification of gas, and anything which they so ascertained was, I think, the property of the public, for whose benefit the Referees were employed by the Government. The Referees considered that it was their duty to disclose to the public the improvements made, and accordingly they prepared a report to the Board of Trade on the subject, in which they recommended certain improvements for the purification of gas. This report must have taken some time in its preparation, and all the three Referees must have known its contents. There were no secrets in the report. The Referees were the servants of the public, and had to give information to the public; and any information possessed by one of the Referees, and communicated to the others, was not a confidential communication, such as might have been made by a master to his servant, but was information communicated by one servant to another for the advantage of their common master, the public. The report was dated Jan. 31, 1872, and its contents must have been well known to the three Referees, and known to them in the way I have stated, prior to that day; but the report was not sent in to the Board of Trade until March 26, 1872. As soon as it reached the Board of Trade it was published, and then became known to all the public. It seemed to have occurred to the appellant after the report had been prepared—and it was dated the 31st of January—and before it was formally delivered to the Board of Trade on the 26th of March, that one of the improvements in the report for the purification of gas, which he claimed to have discovered, might be made the subject of a patent. Accordingly, on March, 9, 1872, he presented a petition for a patent for improvements in the purification of coal gas; and the patent which was subsequently obtained was this which is now before your lordships. He now claims that he is entitled to prevent the public from using this patented process without making a previous arrangement with him, and the present action is brought to try the question. The respondents object to the validity of the patent on the ground that the processes generally (but two in particular) were known before the date of the patent. The Vice-Chancellor repelled the objections to the patent, and upheld it; but the Court of Appeal sustained those objections, and decided that the patent was invalid. Before adverting to the special objections to the patent, I shall refer to the circumstances under which it was granted. I think the position of the Referees, with reference to the report, is well expressed by Lord Justice James, when he says: "It is to be borne in mind that the report, when made, belonged absolutely to the State. Every fact and figure in it had been ascertained and obtained at the public expense. Every hour of every Referee and of the secretary employed in the production of it was public time. It was, of course, printed at the public cost. The withholding or wilfully delaying of it was a plain breach of public duty, and it is difficult to see how the plaintiff can be in a better position than if he and his colleagues had done their duty, and duly presented their report as soon as it was completed. The consideration for every patent is the communication of useful information to the public. What consideration is there when the information was already the property of the State?" The appellant here was, in my view, a public servant, working for the benefit of the public, and bound to give the public all the information and assistance in his power. Any discovery made by him in the course of his public duty was, I consider, the property of the public; and he was not entitled to apply it to his own private advantage. I do not attribute any corrupt motives to the appellant in applying for the patent, but in my opinion, his conduct was not very different, in principle, from that of a servant employed to dig for precious stones, who, when he found one, put it into his own private pocket for his own private purposes, instead of handing it over to his employer. He could not be heard to say that the stone belonged to him, and I am inclined to think that that, in principle, is about what the appellant is saying when he says that he is to have the benefit of the patent in question; for the public not only received no benefit from the patent, but the subject of it was the actual property of the public, who had paid the price for it. I am, therefore, doubtful whether the appellant could have obtained the patent, and whether it was not altogether invalid and void if he did obtain it. I think it is admittedly invalid on the ground that the whole subject matter of it was known to the Referees before the date of the letters patent. Under the circumstances, I think there was no question of confidentiality between the appellant and the other Referees, who were bound to give the public the benefit of the knowledge which they possessed. I quite concur in the observations which have been made by the noble lord on the woolsack with reference to the evidence attempted to be adduced in regard to the alleged confidentiality between the Referees. I do not think there is any evidence in point of fact as to such an understanding as was deposed to by one of the witnesses; and, further, in point of law, I certainly demur altogether to the right of any such confidentiality existing as between them. I am of opinion, supposing the appellant was entitled to obtain the patent, that the patent obtained was invalid, and that admittedly the processes sought to be patented were known to the Referees before the date of the patent. As I have said, I think that, under the circumstances, there was no question of confidentiality between the appellant and the other Referees, and that the Referees were bound to give the public the benefit of the knowledge that they possessed. I think their knowledge of the processes in question was in substance the knowledge of the public, and, therefore, that the processes sought to be patented being known to the public rendered the patent void. To hold that, under the circumstances here, a patent could be taken out, would be to make the report to the Board of Trade a mere sham, for it would be, in fact, giving some information with one hand, and withholding it with the other. I think, under the circumstances, that it is unnecessary to consider the special objections which have been urged by the respondents to the patent; but I have carefully considered the objection to the first two heads of the specification on which the appellant was heard at your lordships bar, and I concur with your lordships in thinking that the modes of purification there claimed were known, and were, therefore, no new means at the date of the patent, and therefore that they were bad *in toto*, and that the patent is invalid. As regards the evidence (which has been fully stated), I do not think it necessary to go into it, and I therefore concur in the opinion expressed by the noble and learned lords.

The Lord Chancellor put the motion to the House that the decree appealed from be affirmed, and that the appeal be dismissed, which motion was carried by the House.

STOCKTON BOROUGH POLICE COURT.—Thursday, Dec. 6.

(*Before the* Mayor *and other Magistrates.*)

CONVICTION OF A WATER COMPANY FOR REFUSING TO SUPPLY WATER.

The Stockton and Middlesbrough Water Company were summoned by Mr. Isaac Friend, of Newcastle, for refusing to supply his property with water.

Mr. Fawcett, who appeared for the prosecution, stated that his client was owner of property in Douglas Street, Stockton, and he complained that the company refused to supply the houses there belonging to him with water. The 43rd section of the Water-Works Clauses Act, 1847, provided that where a company refused or neglected to supply water they were liable to a penalty of £10, and a cumulative penalty of 40s. per day so long as they refused. During the previous week his client went to the offices of the company, and there offered the sum of £2 as a quarter's rent in advance for seven houses in the street named, and requested them to supply the water to the houses; but, notwithstanding that, the company refused to do so, and had not put the water on. They said there was an old account standing, which must be paid first, and they would not put the water in unless that account was paid. He believed there was a disputed case between the company and Mr. Friend, in which the former claimed £11 odd for supplying water to these and other houses, but in this the company had charged in excess of their powers, and had not allowed for rates or empty houses. To recover the claim they took out a summons, but when it was set down for hearing they withdrew it, and then, after withdrawing it, they cut the water off in these and forty other houses. The authorities then found that the houses were unfit for human habitation, and ordered them to be closed. Consequently the tenants left, and the owner was a loser of the rents. His (Mr. Fawcett's) contention was that, when the money was offered, the company were bound to supply the water, and could not refuse to do so on the ground that an old score remained unsettled. If this was the way in which the company were treating the public, it was quite time the concern was taken out of their hands. His client was quite willing to meet the company, and pay them as far as what was their due.

Plaintiff was then called, and deposed that he was the owner of seven houses in Douglas Street, Stockton. On the 30th ult. he went to the office of the company, where he saw Mr. Berry, their manager, whom he told that he wanted the water put into the houses. Mr. Berry said he would not put it in; and he asked the reason, but was told that he was not bound to give any reason or explanation. Plaintiff then offered him 30s., and told him to put the water on; but that being refused, he offered £2, which was more than was the proper charge for a quarter's rates. Mr. Berry then said he would not put it in for less than £11. The old claim was against these and other houses. He offered to pay the company for the new supply, which was according to the rules.

Cross-examined by Mr. Webster, who appeared for the company: A man named George Peacock collected rents for him up to the 12th of November as his agent, and since that time he had collected rents with-

out authority. He knew that an action was brought against Peacock as his agent for the arrears of water-rent.

Mr. WEBSTER: Are you aware that it was withdrawn because Peacock agreed to pay the amount?

Plaintiff: I have not seen Peacock; he keeps out of the way.

Mr. WEBSTER: Are you not aware that the summons was withdrawn by consent with Mr. Berry and your agent, because he admitted the money was due and agreed to pay it?

Plaintiff: He had my instructions not to do anything without my authority in writing.

Mr. WEBSTER repeated the question.

Plaintiff: I am not aware of it. I am not aware of anything of the kind. Peacock was acting on my behalf. He paid the water-rents before this time. When I went to the office I did not say anything with respect to Cambridge Street. I am the owner of the property, but have not the deeds here to prove it.

By Mr. FAWCETT: The company have not put the water into either Douglas Street or Cambridge Street.

Mr. WEBSTER, on behalf of the company, said he should take objection to the complainant as not being the owner of the property. He must prove in a proper and legal manner that he was the owner of the property, and this he must do by the production of his title-deeds, or how were they to know that he was the owner? The company recognized the person who was in receipt of the rents as the owner. This the Act of Parliament clearly, and to all intents and purposes, defined. They recognized Peacock to be the owner of this property, and he was summoned to that Court by the company, but before the case came on he agreed to pay the money, and the case never came before the Bench. It was evident that there was something due to the company from the property, as the manager told complainant that if he paid the £11 he should have the water put in. They said that that money was due to them, and his objection was that complainant must prove that he was the owner of the property. Any persons might spring up and say they were the owners of places.

The MAYOR: Is not that wasting our time? If the Act goes so far as that, it is just necessary to adjourn the case to produce the deeds.

Mr. WEBSTER said his friend must put himself in a proper position. This was a legal objection. The plaintiff's case was closed, and it would be unfair to adjourn for him to make his case good. The next objection he should take was that the other side had not proved that the property was within the limits of the company defined by the Act of Parliament. He should also contend that there was no obligation, under the 43rd section, binding the company. With respect to the cumulative penalty of 40s. for every day during which the refusal or neglect continued, the clause provided that that was only "after notice in writing shall have been given to the undertakers of the want of supply." No such notice in writing had been given in this case.

Mr. *J. W. Berry* said that he was the company's agent at Stockton. He knew the plaintiff's agent. His name was George Peacock, and he had been in receipt of the rents in respect of some property in Cambridge and other streets, and had paid the company's rates as the other agents had done. For the first quarter he was agent for Mr. Friend, witness had to summon him, but he paid the water-rate before the case came on. He had also applied for the sum of £11 1s. 6d. time after time, and he took out a summons for it, which was adjourned at the first hearing, and then he arranged with Peacock to pay it, but he had not done so yet. When Mr. Friend saw him at the office, Cambridge Street was spoken of, and Douglas Street was never mentioned.

Cross-examined by Mr. FAWCETT: The summons was for water supplied by the company. The agent had previously paid the water-rents when they were demanded.

Mr. WEBSTER argued that the plaintiff had not shown that he, as owner of the property, was entitled to demand a supply. He had not shown that these were houses or tenements of less than £10 annual value.

Mr. FAWCETT answered that the plaintiff, in his examination, stated that the houses were under £10 annual rental.

Mr. WEBSTER then contended that under the 74th section of the Water-Works Clauses Act the company had a right to cut off the water if the rates were in arrear.

Mr. FAWCETT having been heard in reply,

The CHAIRMAN said the Bench had decided to convict the company, and to impose a penalty of £5.

Mr. WEBSTER asked for a case, which was refused.

THURSDAY, DEC. 13.

The plaintiff in the above case applied this day for a summons against the same defendants for refusing to supply water to other property of his at Stockton. The facts elicited were similar to those at the hearing of the previous case, when the company were fined; and as the defence was the same, and it transpired the company were going to appeal, the Bench decided to adjourn the matter for a month, pending the result of the appeal.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

METROPOLITAN BOARD OF WORKS.—At the meeting on Friday last, the Works and General Purposes Committee made a report upon the report of the Fire Brigade Committee of the House Committee, which, *inter alia*, recommends that the administration of the affairs of the Brigade should be taken out of the hands of the Board and handed over to the Metropolitan Police Department, to which proposition, of course, the committee object. They state that they entirely agree with the recommendation of the committee, that the water system should be consolidated in the hands of a public authority. The efficiency of fire arrangements in Liverpool and Manchester was due in great measure to the fact that both the fire service and water supply were under the control of one authority, and to attain the same efficiency in London could only be done by unity of management. This unity could not be secured if the Fire Brigade was made a branch of the police, for no one, it was presumed, would propose that the police should be made the authority to supply water to the Metropolis, with power to levy rates, and exercise all the other functions which would devolve on the water authority. The alternative was to place the water supply under the control of the Board, and this duty they had been for years willing to undertake. Bills for the purpose were about to be submitted, and if these measures received the sanction of the Legislature, the Board would be in a position to establish a system of fire extinction more effective than could be attained under any other conditions.

COURT OF COMMON COUNCIL.—At the meeting of the Court, on Thursday last, a report was submitted by the Gas and Water Committee upon several references made to them in relation to the erection of hydrants for the extinction of fire. The report stated at length the various steps taken by the committee, and quoted several passages from the report of the Committee of the House of Commons on the Metropolitan Fire Brigade. The committee recommended the further extension of the system of hydrants for the extinction of fire, by completing it throughout the whole of the City. With a view to enable the committee to advise as to the best mode of carrying that out, the engineer of the commissioners had, at their request, reported upon the pressure of water obtainable at various points from the mains of the New River Company, and it appeared that the pressures generally throughout the City were capable of giving at all times very efficient jets for the extinguishing of fires, and that when the proposed additional pressure was provided by the company, jets varying from 82 to 104 feet in height might be obtained. The engineer had also reported to them as to the number of branches and hydrants required to complete the system throughout the City, in addition to the 262 branches and hydrants authorized by the Court of Common Council in the different streets which had been repaved during the last three years, and for the estimated expenses of which provision had already been made. By these reports it appeared that the number of additional branches required was 447, and 447 hydrants would have to be affixed to these branches, at an estimated expense of £14,175. The amount of the contribution of the Commissioners of Sewers, on the assumption that they would contribute in the same proportion as they had hitherto done, was estimated at £4399, leaving £10,746 as the amount chargeable to the corporation. The committee also reported that 262 branches previously ordered were completed, that 100 hydrants had already been fixed, and that 162 hydrants were required to finish the work already authorized by the Court. This had cost the Corporation and the Commission £7216, which, with the present estimated expense of £14,875, would give £22,091 as the total estimated cost of establishing hydrants inthe City. Of this £15,651 was chargeable to the Corporation, and £6440 to the Commission. They recommended that the work should be undertaken, but from its nature, and the impediments and delays which must necessarily arise in placing branches in the streets of the City, it was probable that not more than half the amount would be required during the ensuing year. Captain Shaw had been informed of the position of the various hydrants already laid down, in order that they might be at once available for the extinction of fire if required. The Metropolitan Board of Works had now adopted the principle first enunciated by the committee in July, 1874, and agreed to by the Court, as to the desirability of establishing hydrants with a constant supply for the extinction of fire in the place of the system of plugs; and the Board had agreed to the recommendation of the engineers to whom they had referred the question, and were taking steps to carry out the principle throughout the whole of the Metropolis, by giving notices of Bills to be introduced into Parliament during the ensuing session for the purpose of enabling them to do so. Mr. Shuter moved the adoption of the report, and stated that trials had recently been made of the hydrants at present in working order, the results of which were most convincing as to the great value and importance of the provision. Captain Shaw had expressed himself highly satisfied with what these hydrants were capable of accomplishing, as each one of them could at any time be made to yield a jet of water equal to that provided by any one of his engines. He believed if the recommendations of the committee were carried out, great fires in the City would seldom occur. An amendment was moved, but not seconded, referring the report back for further consideration, for the purpose of the committee testing and reporting upon the various appliances, either chemical or any other invention, now in use for the extinguishing of fires. A further amendment to refer the report back for the purpose of obtaining more information as to the cost of hydrants was negatived, and the report was adopted.

WATER-RATES IN SOUTHWARK.—A public meeting was held at the Bridge House Hotel, London Bridge, last Thursday evening, "to express," as the placards announcing the meeting put it, "the indignation felt in the district at the injustice of the course taken by the Southwark and Vauxhall and other water companies, in abruptly and largely increasing the rates, and to consider the best means of remedying this grievous wrong." The meeting was numerously attended. Colonel Beresford, M.P., presided, and, in opening the business, said that light, locomotion, and water were three most important necessaries, and that, with the usual dislike to official interference, these had been left in the hands of private companies, and these companies required keeping in order by a tight rein. He was concerned in two of such companies; but, at the same time, he urged that light, locomotion, and water should be regarded as the gift of God, and that, therefore, people were entitled to them at the most reasonable price. With regard to light and locomotion, he did not think there was much to complain about; but, with regard to the water supply of the Metropolis, he saw the necessity for a radical alteration. A great change, however, could not be accomplished in a moment. He referred to his own efforts in promoting a Bill which had for its object—1, the placing of the water supply of the Metropolis in the hands of a commission; 2, that there should be a constant supply; 3, that there should be hydrants distributed throughout the Metropolis. This had been tried successfully in several important provincial towns. The same principles had recently been approved of by the Select Committee on the Fire Brigade, and, he believed, also in the Bill which the Metropolitan Board of Works were promoting. Mr. Brookes, the secretary of the South London Gas Consumers Protection Association, at whose instance, it was stated, the meeting had been convened, gave some instances of alleged overcharge in the water-rates by the Southwark and Vauxhall Company, after which a series of resolutions were unanimously carried, strongly deprecating the recent action of the company; declaring that to construe the clause in the Act of Parliament authorizing the levying of a rate "at not more than 5 per cent. on the annual value," as giving power to charge 5 per cent. irrespective of the quantity consumed, was straining the Act beyond what was intended; and appointing a deputation of twenty to wait upon the Home Secretary, and the Metropolitan Board, to urge the necessity of the application of the meter system (as for gas) as the only fair means of charging for water. The tone of the speeches was one of decided hostility to the continuance of the monopoly of the water companies, and expressive of a determination to place the water supply under municipal control, some distrust, however, of the Metropolitan Board of Works being manifested. At the close a vote of thanks was given to Colonel Beresford, who, in acknowledging the same, announced that he should reintroduce the Bill he brought forward on the subject last session.

Dr. Frankland reports, as the result of his analyses of the waters supplied to the Metropolis and some of its suburbs during November, that taking unity to represent the average amount of organic impurity in a given volume of the Kent Company's water during the last nine years, the proportional amount of such impurity in an equal volume of water supplied by each of the other companies, and by the Tottenham Local Board of Health, was—Tottenham 0·4, Kent (Shortlands) 0·6, Kent (Deptford) 0·8, New River 0·8, Colne Valley 0·9, East London 1·2, West Middlesex 2·1, Grand Junction 2·6, Lambeth 2·9, Southwark 3·2, and Chelsea 3·5. The water supplied to London from the Thames by the Chelsea, West Middlesex, Southwark, Grand Junction, and Lambeth Companies was efficiently filtered before delivery, and was, as regards dissolved organic impurities, of medium quality. That supplied from the Lea by the New River and East London Companies was of very good quality, and was efficiently filtered before delivery. The water drawn from deep wells by the Kent and Colne Valley Companies, and by the Tottenham Local Board of Health, was of its

usual excellent quality for dietetic purposes, and that delivered by the Colne Valley Company was soft, and therefore suitable for washing. The exceptional impurity noticed last month in the Colne Valley Company's water had entirely disappeared. To trace its source, Dr. Frankland analyzed samples of the company's water both before and after softening, and also a sample from a well now being sunk into the chalk by the London and North-Western Railway Company at a distance of about 800 yards from the Colne Valley Company's well. The water in the railway well was very foul, and any considerable admixture of it would undoubtedly pollute the Colne Valley Company's water, but he had not been able to trace decisively any communication between the two wells. The results of the analyses of these additional samples are given in the accompaning table. Seen through a stratum 2 feet deep, the water supplied by the Kent and Colne Valley Companies, and by the Tottenham Local Board of Health, was clear and colourless; the New River Company's water nearly so; the water distributed by the East London, West Middlesex, and Chelsea Companies very pale yellow; and that by the Southwark, Grand Junction, and Lambeth Companies pale yellow.

Results of Analysis expressed in Parts per 100,000.

Companies or Local Authorities.	Total Solid Matters.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrogen, as Nitrates and Nitrites.	Total combined Nitrogen.	Chlorine.	Total Hardness.
Inner Circle.								
Thames—								
Chelsea	27·10	·164	·043	0	·213	·256	1·65	20·0
West Middlesex	27·80	·109	·013	0	·182	·195	1·65	21·0
Southwark and Vauxhall	29·60	·147	·043	0	·193	·236	1·65	22·1
Grand Junction	28·70	·119	·032	0	·230	·262	1·60	21·4
Lambeth	25·20	·150	·023	0	·157	·180	1·65	18·0
Other Sources—								
New River	28·40	·032	·016	0	·256	·272	1·55	22·1
East London	30·40	·052	·018	0	·187	·205	1·80	23·0
Kent (Deptford Wells)	41·54	·033	·015	0	·581	·596	2·45	27·7
Kent (Shortlands Wells)	31·30	·032	·005	0	·387	·392	1·57	23·7
Outer Circle.								
Colne Valley	37·00	·075	·021	0	·298	·319	1·35	29·3
Ditto	11·46	·037	·018	0	·340	·358	1·40	4·0
Ditto	48·60	·357	·068	·020	0	·084	1·93	33·5
Tottenham Local Board	45·60	·017	·006	0	·304	·400	3·10	27·1
Corporation of Birmingham*	24·38	·304	·049	·003	·187	·238	1·50	13·0
Corporation of Glasgow†	2·60	·258	·023	0	·004	·027	0·70	1·1

* Analyzed by Dr. Alfred Hill, Medical Officer of Health and Analyst to the Borough.
† Analyzed by Dr. E. J. Mills, F.R.S., of the Andersonian University, Glasgow.

Note.—The numbers in the analytical table can be converted into grains per imperial gallon by multiplying them by seven, and then moving the decimal point one place to the left. The same operation transforms the hardness in the table into degrees of hardness on Clark's scale.

The Registrar-General publishes the following returns of the average daily quantity of water supplied by the London Water Companies during the month of November, 1877. According to these, 118,045,077 gallons, or 536,333 cubic mètres of water (equal to about as many *tuns* by measure, *tons* by weight) were supplied daily; or 219 gallons (99·5 decalitres) rather less than a *ton* by weight, to each house, and 30·9 gallons (14·0 decalitres) to each person, against 29·9 gallons during November, 1876.

Companies.	Number of Houses, &c., supplied in Nov., 1876.	Number of Houses, &c., supplied in Nov., 1877.	Aver. Daily Supply of Water in Gallons* during Nov., 1876.	Aver. Daily Supply of Water in Gallons* during Nov., 1877.
Total supply	531,191	538,499	112,621,763	118,045,077
From Thames	250,440	253,850	57,410,960	59,413,720
,, Lea and other Sources	280,751	284,649	55,210,803	58,631,357
THAMES.				
Chelsea	28,737	28,859	7,106,900	8,183,300
West Middlesex	48,611	50,065	9,725,639	9,204,217
Southwark and Vauxhall	80,690	79,320	18,150,000	18,350,000
Grand Junction	37,055	37,922	10,511,521	10,554,803
Lambeth	55,347	57,684	11,916,900	13,121,400
LEA AND OTHER SOURCES.				
New River	125,015	126,027	24,701,000	26,363,000
East London	110,354	113,190	23,612,600	25,089,800
Kent	45,382	45,432	6,867,203	7,178,557

* Including that for manufactures and for various purposes other than for domestic consumption.

Note.—The return for November, 1877, as compared with that for the corresponding month of 1876, shows an increase of 7308 houses, and of 5,423,314 gallons of water supplied daily.

SOUTHWARK AND VAUXHALL WATER COMPANY.

The Half-Yearly General Meeting of Proprietors was held at the Company's Offices, Sumner Street, Southwark, on Thursday, the 13th inst. —HENRY WHITING, Esq., in the chair.

The following reports and statements of account were presented:—

The directors beg herewith to submit to the proprietors the half-yearly statement of accounts of the company to the 30th of September, 1877, which have been duly certified by the public auditor appointed by the Local Government Board, and by the auditors of the company.

It will be within the recollection of the proprietors that considerable alterations were effected both in the staff of the engineer and the secretary previous to the last general assembly, with the view of ensuring greater efficiency in the working of their respective departments; also that a new department had been organized for the purpose of supervising the collection of the water-rates, and for obtaining information and the correct assessments for entry in the company's rate-books. The working of all these departments has progressed satisfactorily during the half year, and your directors believe that this re-organization has been productive of beneficial results.

The shareholders were informed at a previous meeting that negotiations had been entered into with the General Property Investment Company, for the sale and purchase of a portion of the company's land at Battersea; the sale by mutual consent has been annulled.

£23,000 of the company's mortgages, averaging 4½ per cent. interest, having come to maturity during the half year, have been paid off, and your directors have succeeded in placing a like amount of the company's 4 per cent. perpetual debenture stock in lieu thereof.

The cleansing, reinstating and improving the filter-beds, both at Battersea and Hampton, have been energetically carried on during the half year, and have resulted in greatly improving the quality of the water supplied, but entail a heavy burden on the current revenue of the company; for more detailed information on this matter, your directors refer you to the engineer's report, which they have ordered to be sent herewith.

The Metropolitan Board of Works have resolved to apply to Parliament for powers to purchase the interest of the existing water companies; they have also given notice of a Bill, asking parliamentary powers to enable them to give a new and independent supply of water for drinking and culinary purposes, and for the extinguishment of fire, and to construct and maintain the necessary works connected therewith. It remains to be seen whether Parliament will approve of these schemes, and especially the latter, which will cast a most extraordinary burden on the ratepayers. Your directors, however, will carefully watch the interest of the shareholders, but desire to avoid the expense of a parliamentary contest, and invite your opinion thereon.

Three of your directors, Mr. Alderman Stone, Mr. Noel Whiting, and Mr. Alderman Finnis, retire by rotation, and, being eligible, offer themselves for re-election.

One of your auditors, Mr. John Young, also retires by rotation, and, being eligible, offers himself for re-election.

In order to simplify the stock and share accounts of the company, and for the greater convenience of registration, your directors recommend that the 700 fully paid-up £100 new ordinary No. 1 shares of the company be converted into the existing ordinary stock, and a resolution to that effect will be submitted to you at an extraordinary meeting to be held immediately on the conclusion of the ordinary half-yearly general meeting, in accordance with the powers and provisions of the Companies Clauses Consolidation Act of 1845 in that behalf.

Your directors recommend that a half year's dividend at the rate of 2 per cent. per annum on the ordinary stock and class D shares, 5 per cent. per annum on the preference stock and the preference shares, £4 10s. per cent. per annum for one quarter, and 2 per cent. per annum for the remaining quarter on the new ordinary No. 1 shares of the company, be declared payable on and after the 15th day of January, 1878.

In recommending the above dividends, your directors desire to state that this cannot be considered as the real amount of dividend earned. The actual earnings, it will be observed by reference to the accounts, are charged with amounts which, had not the condition of things rendered this expenditure necessary, would have been available for dividends among the shareholders. Amongst the items so charged in the half year are—

Capital suspense account (Harvey and Co.)		£4000 0 0
Battersea land	£1500 0 0	
Expenses in reference thereto	509 15 9	
		2009 15 9
Paving account, 1873		182 14 11
Restoration of filters		7597 14 3
		*£13,790 4 11

or, in other words, more than 3 per cent. per annum in excess of the dividend now recommended.

These extraordinary charges will, to some extent, cease after a short time, when the financial prospects of the company will assume a more healthy and satisfactory condition.

ENGINEER'S REPORT.

Engineer's Office, Sumner Street, Southwark, S.E., Nov. 30, 1877.

To the Chairman and Directors of the Southwark and Vauxhall Water Company.

Mr. Chairman and Gentlemen,—In conformity with your instructions, I have the honour to present for your information a report of the works and the general working of the company during the past year.

It affords me great pleasure in this review to be able to state that all the works—pumping, filtration, and distribution—are making marked progress, and are in a much more satisfactory condition than they have been for years past. With your permission, I propose taking up the subjects from my last report, dated Nov. 30, 1876.

For the more easy reference, I will deal with each of the company's stations separately, commencing at Hampton.

Hampton Works.

In order to assist during the winter the subsiding reservoir, a screen was erected across the same about 250 feet in length. Since its erection in 1876 it has done the company good service, but was not erected as a permanent work.

The three filters at this station have been thoroughly overhauled, and the filtering medium washed down to the flooring of the filter-beds, and then reinstated and made up to such a thickness as to place them upon an efficient footing, while a large amount of surplus sand for renewal and maintenance has been placed in stock.

Constant care has been devoted to the engines, boilers, and other mechanical appliances in connection therewith, so that they are being brought into a fairly good and workmanlike condition.

In order to save the filtered water at this establishment, hitherto used for feeding the boilers and condensers, mechanical arrangements have been made for using unfiltered water, thereby saving something like 500,000 gallons of filtered water per day, and doing the work more efficiently; this arrangement will further enable the filters to be drained more readily for the purpose of cleaning out.

The engine repairs have been done at this station by our own staff without increase of wages, contrary to the practice hitherto adopted.

I may also mention that weigh-bridges have been put down at these works for the purpose of checking materials and coal taken into store or purchased.

Battersea.

The filter-beds at these works are rapidly undergoing reconstruction and division in many cases. A difficulty has always been experienced in reference to the sufficiency of filter area when any of the beds had to be cleansed, although, as a fact, from the filters being much too large, the area was in excess of the requirements of the station; so that when one was put out of use a large area of filtering power was withdrawn; they also took a very long time to cleanse and reinstate, causing the maintenance of an increased and expensive staff for the purpose. Some of the filters are now being divided into areas of about three-quarters to an acre each; this will greatly facilitate the working. It has been a great expense. It is not yet completed, and probably will not be until the spring of the coming year. I would note, in passing, that the filters were originally constructed upon the crudest principle possible, and the materials used in most cases absolutely unsuitable for the purpose, inasmuch as they do not appear to have been washed or stratified upon any principle.

The largest of the two reservoirs has been thoroughly cleaned out and lime-whited, and the small one is now going through the same process.

This brings me to the machinery department. Nos. 1 and 2 engines have been thoroughly overhauled, every portion taken to pieces, and such parts reinstated with new work as the circumstances of the case required. No. 4 engine is now undergoing similar treatment. The repairs to No. 1 engine, for labour and materials, adding a per centage for the use of tools and shop charges, amounted to £138 12s. 4d., and No. 2 engine cost something like £155. The whole of the work is performed by our own men. The amounts paid formerly for repairs, when the work was put out, amounted to between £3000 to £4000 yearly, while the pay-sheet for labour is now, if anything, less than formerly.

Due attention has been paid to the efficiency of the boilers at these works. And while not disguising the fact that they are of very ancient date, at the present time, I think, with a little care, they may be considered in a fairly serviceable condition.

Previous to my taking charge (July 21, 1876), for some reason hitherto unexplained, valves and old stores were not returned to the company's yard. At the present time all the old material is returned to the stores, and all cocks removed from any cause from the district are taken to the company's fitting-shop at Battersea, repaired, and sent out again for service in the district; we have so repaired 43 cocks. Though many of them are not of the most modern pattern, still they will be found to be good and serviceable for the work.

The custom of the company heretofore was to supply this station with gas made on the premises, at a cost of something like 8s. 6d. to 9s. per 1000 cubic feet. But, under the instructions of the board, these works have been removed, and the gas is now supplied by the London Gas Company at 3s. 6d. per 1000 cubic feet.

That portion of the works hitherto used as a retort-house in the manufacture of the gas has now been converted into a meter-testing and repair shop, at very trifling expenditure of capital; the company are thus enabled to repair and test the meters supplied to the customers.

Most of the tools used by the turncocks and labourers on the district are now repaired at this station by our own men.

And, further, there has been erected at this station, as in the case of Hampton, a weigh-bridge and office for the purpose of checking the materials delivered into the store.

During the past year, satisfactory improvement has been made in the plant and machinery generally, and a large addition made in the plant, to enable the company to do their own repairs and extension of works throughout the district, when found more economical to do so.

Peckham.

Since my last annual report, Mr. Bateman's report and recommendations have been under serious consideration, though, up to the present time, no conclusion has been arrived at; certain alterations are being carried into effect in reference to the distributing mains, and the construction of a valve-house and other mechanical appliances to bring under immediate control the ingress and egress of water to these reservoirs when taken into charge. The outstanding balance due to Messrs. J. Aird and Son on the Peckham extension works contracts has been settled at £233 18s. 2d., closing that portion of the work so far as the contractors are concerned.

Generally.

The maximum engine duty reached during the last twelve months, shows, from the 30th

* In addition to the foregoing, a sum of £762 12s. hitherto charged to new supplies, &c. (capital), has been debited this half year by the auditor to revenue.

of September, 1876, to the 25th of March, 1877, the duty to have been 71,726,866 foot pounds per cwt. of coal, and from the 25th of March to the 30th of September, 1877, 84,004,090 foot pounds per cwt. of coal. When I took charge the return only reached 54½ million foot pounds per cwt. of coal; and alike the consumption will be of interest:—

	Tons.	Cwt.
From Sept., 1875, to Sept., 1876, quantity consumed was .	18,742	7
From Sept., 1876, to Sept., 1877, quantity amounted to . .	17,240	18
Making a saving during year of	1501	9

Since July last, the water supplied to the district by the company has been analyzed and reported upon monthly by Dr. C. Meymott Tidy, M.B., and his analyses shows the same to have been of a very satisfactory and good quality throughout this period. A copy of the analysis has, in each case, been forwarded to and published by the Government Water Examiner.

During the past year alterations have been made throughout portions of the district in order more efficiently to conduct the service of distribution. At least an addition of 13 miles of main have been placed under constant pressure, making altogether some 113 miles of mains available for constant supply. A better idea of the new work done in this respect during the year will be gathered from the fact that 15,836 yards, or about 392 tons, of pipes have been laid in the district.

In the report of the 30th of November, 1876, at page 6, your attention was directed to an experimental meter placed at a certain customer's, which clearly proved the consumption to be greatly in excess of the rental received or of their requirements. This experience led your directors to give instructions to put down at several other points similar test-meters, which must result in checking waste, and further increasing revenue to a considerable extent.

The unremitting exertions of the department to check the intolerable waste of water in the district are producing beneficial effect, insomuch that at Battersea, when all the engines are in working order, we are now able to keep one idle as a "stand-by," thus diminishing expenditure. It is marvellously incredible how whole communities thoughtlessly, and, you may say, recklessly, persist in such waste of water as is found to prevail; and especially where large numbers of hands are employed. Consumers more or less, as a rule, appear to be utterly unconscious of the waste going on. Since the 2nd of October, 1876, a record has been taken of the work done by the waste inspectors, and the result shows that 14,974 houses have been inspected.

Houses inspected	14,974
Number of notices served, which may include several houses in one notice	8,927
Complied with, and waste stopped	9,137
Cisterns found in a leaky condition.	3,525
Broken service-pipes	747
Ball-valves wanting	5,256
Ball-valves out of order	2,094
Closets supplied by overflow-pipe	1,806
Closet-valves out of order.	214
Draw-taps out of order	749

All of which defects are now being rectified.

The complaints from the district generally, when I first took charge, amounted to something like 4000 per annum, and they are now reduced to something like 400 a year, of which, upon investigation, not more than one-sixth can be classified as *bona fide* complaints.

The last season's road-watering service has been improved and increased by about 10 miles, and preparations have and are being made for a more extended and efficient service next season, arising out of negotiations from the several parishes.

The old inefficient telegraphic communication under a contract having still four years to run, and for which the company paid £190 per annum, has been advantageously determined by a payment of £216 5s., under the advice of the Board, and arrangements have been concluded with Her Majesty's Postmaster-General for the construction and maintenance of an efficient telegraphic service between the whole of the stations and the company's offices, with the use of the Wheatstone instruments.

Your periodical visits to the several pumping-stations and portions of the district during the past year will the better enable you to control expenditure, and appreciate the improvements already effected.

In conformity with your instructions, a beneficial contract, under substantial security, for laying a 30-inch main under the River Thames, at Richmond, has been entered into with Mr. George Furness, of Westminster. The laying of this main has been so arranged as to do away with the necessity of constructing a dam for the purpose—at all times an expensive operation.

Metropolitan Supply.

The Metropolitan Board of Works have already issued notices to enable them to deal with the supply of water to the Metropolis for all purposes, and further to acquire the existing companies. They have called to their aid for the purpose of advising them, in conjunction with their own engineer (Sir Joseph Bazalgette), two gentlemen of recognized position in the profession. It is alleged at the present time that the river supplies generally are yearly deteriorating; yet, if we take all things into consideration, it is only correct to say that the London river water supply was never in a better condition than during the past season, as regards quantity and quality. And if we remember that at Brentford the minimum daily flow in exceptionally dry seasons gives over 360 million gallons per diem, there appears to be no cause for alarm on the score of quantity, and the quality is equal, taking all things into consideration, alike for domestic and manufacturing purposes, to any other water that can be supplied. The extreme refinement of modern analyses has seemingly led chemists to set up a standard of purity in excess of the necessities of the case, for never were the bills of mortality at a lower rate. The present maximum supply to London does not exceed 130 million gallons per diem, some 80 millions of which only is taken from the Thames.

Captain Shaw has constantly reminded the Metropolitan Board of Works that an improved water supply for fire extinction is more and more urgent every year, and in his evidence before the Fire Brigade Committee he states that over 2000 gallons of water per minute are needed for the extinction of a large fire. This represents a supply of something like three million gallons per day, or about 1-43rd of the entire supply, whereas experience in the Metropolis shows this is very much in excess of the actual requirements.

The experience gained at the fire of Chicago, which was visited by your engineer, shows clearly that there are matters requiring serious consideration, and necessary for the safety of a large, important, and wealthy commercial city in regard to fire prevention and extinction other than water, and of equal importance. I refer to structural improvements.

No doubt it was upon the data of this large supply, asked for by Captain Shaw, that Sir Joseph Bazalgette and Messrs. Bramwell and Easton were instructed to prepare a scheme, and report thereon to the Metropolitan Board of Works, for the best means of providing an auxiliary supply of water for fire extinction and other purposes in the Metropolis. These gentlemen recommend that some 20 wells be sunk in the chalk, and, by proper pumping appliances, the water be conveyed to reservoirs of sufficient elevation, and thence distributed throughout the Metropolis by an entirely new set of arterial mains (to be laid side by side throughout the various streets of this vast Metropolis, already overcrowded by gas and water mains, sanitary and other appliances), and to which they propose to connect the necessary branches and hydrants for fire-extinction and road-watering purposes; and also an air-vessel within the dwelling to discharge from 2 to 10 gallons of water per day for domestic purposes. To accomplish this small supply of 16 million gallons of water they estimate an expenditure of 5¼ millions sterling! They propose to give 2 gallons per head per diem of potable water for drinking and cooking purposes, which equals about 8 million gallons per day. How far 2 gallons per head per day, *including waste*, will be a sufficient auxiliary supply for *all these* domestic purposes is a question which admits of very grave doubts by those accustomed to deal with the water supply to large towns; but assuming they get 16 millions of water daily within this area for the present consumption, it appears to me very doubtful whether the chalk stratum would support such a heavy drain, beyond its present and prospective calls, for very many years to come. Even the experience gained from the wells connected with the Kent Company would not, I venture to think, do other than confirm this view. My belief is supported by the Rev. W. Clutterbuck, no mean authority, who has pointed out the very serious consequences that might arise from such a drain from the chalk. Several of the rivers, tributaries of the Thames—notably the Lea, the Colne, the Wandle, and the Ravensborne—have their origin in springs from the chalk, so that if a large quantity of water be pumped therefrom it may diminish the flow of those streams. This point certainly deserves very serious consideration. Another view is, the lay of the land, which may cause anxiety in reference to the question of compensation to millowners and others at present who may think they are in the enjoyment of water rights. I think there can be little doubt sufficiently formidable suggestions and objections will be offered during the ensuing session of Parliament to render it extremely undesirable to develop and bring into practice the scheme thus presented, and such an important question will undoubtedly require the consideration of Parliament and its committees for more than one session before the matter can be disposed of.

The Metropolitan Board will not only have to take into consideration the purchase of existing works, which may amount to something like 20 to 25 millions sterling, but they will have to consider that this first step must be supplemented by a further sum equal to, if not in excess of, that amount, before the scheme can be finally and successfully carried out; and it seems very doubtful whether the ratepayers will consent to the expenditure of such an enormous sum as this scheme foreshadows, when the stern truth comes to be laid before them by the inquiry that must take place before Parliament.

Conclusion.

The state of the works and district before taking charge was such as not only to give your engineer a considerable amount of anxiety and labour, but entailed the like upon his staff. I take the present opportunity of noting the extreme attention and energy of my staff generally, mentioning by name my chief assistant, Mr. J. W. Restler, and to these gentlemen I beg to tender my best thanks. (Signed) Thos. W. Rumble, C.E.

Dr.—Revenue Account, for the Half Year ended Sept. 30, 1877.

Maintenance.						
To Maintenance and repair of impounding and service reservoirs, filtering-beds, works, and pipes, for obtaining and storing of water, including the cost of materials and labour	£251	18	4			
Maintenance and repair of mains, pipes, fittings, meters, and works connected with distribution of water, including the cost of materials, labour, and renewals	4,809	13	8			
Repairs of engines, &c., at the several works, included in Messrs. Harvey's accounts	4,000	0	0			
Pumping and engine charges, including the cost of coals, wages, &c.	10,334	10	1			
Filtration, including cost of materials and labour. .	8,488	13	2			
Salaries of engineer, superintendent, and clerks, and wages of inspectors and turncocks	2,435	14	2			
Rents	26	5	0			
Thames Conservancy	805	5	0			
Rates and taxes	4,129	11	7			
				£35,231	11	0
Management.						
Allowance to directors	£558	15	0			
Allowance to company's auditors	21	5	3			
Salaries of secretary, accountant, and office clerks .	970	15	4			
Superannuation	304	1	3			
Commission to collectors	1,648	6	5			
Stationery, printing, and general establishment charges	620	2	4			
Law and parliamentary expenses	225	14	4			
Expenses connected with Battersea land	2,009	15	9			
Official auditor and water examiner	95	14	8			
				6,454	10	4
Balance carried to next account to provide for losses.				3,500	0	0
Dividend and interest account for transfer of profits.				31,712	7	8
				£76,948	9	0

Cr.—Revenue Account.

By Balance brought from last account . . .				£3,500	0	0
Less allowances for empty houses .	£1,567	18	5			
Ditto overcharges . . .	326	14	9			
Ditto bad debts	704	16	3			
				2,599	9	5
				£900	10	7
Water-rents accrued to the date of this account . .				£74,212	11	3
Surcharges on water-rental to March 31, 1877 . . .				1,743	11	7
				75,956	2	10
Rents received				91	15	7
				£76,948	9	0

The Chairman: Before I formally move the adoption of the report, it may be expected that I should to some extent enlarge upon its contents. I need not tell you that it is equally painful to your directors, and especially to me, to offer, and you to receive, 2 per cent. Going into the matter of the Battersea land first, you may recollect that negotiations were entered into with the Property Investment Company for the sale of something like 5½ acres, including the whole frontage—1340 feet—for the sum of £41,000; but as the intending purchasers asked this company for concessions other than those specifically stated in the contract for sale, the directors came to the conclusion, from further advice which we afterwards had, that it would be greatly to the ultimate advantage of this company that the negotiations for the sale should be rescinded. This determination, however, of necessity entails the very heavy charge of £2000 to revenue; but its object was accomplished by mutual consent, in an amicable manner. I may here tell you how we come to that £2000. These gentlemen came from Scotland; I think there were five or six directors up here for two or three months, and they considered that they had made such an excellent bargain that they said, "You must give us something to be off." We said, "We keep ourselves to our conditions;" and eventually we settled the matter amicably, on payment of £1500 to them all, £400 to the man who had sold the land, and £100 for our law expenses. Towards that sum we had the interest on the £6000 which they had deposited with us. We have been advised that at no very distant date this site must be discontinued as a pumping-station; and should the land be sold in its entirety—the whole 50 acres which we have—there can be little doubt that it will realize a sufficient amount to pay for the construction of other works upon a more suitable site. In the proper selection of a new position for those works, an additional advantage would be gained to the company in the curtailment of working expenses, by obviating the necessity of pumping two-thirds of our water twice over. Therefore about £2000 have had to be expended in cancelling this matter. The directors feel that they acted rightly in the retention of the land. At the same time, it is only right I should tell you that the contract for this sale was, in the first instance, entered into solely upon the advice of our late engineer, and we are bound to take the advice of a professional man in a matter of this kind. The next item to which I direct attention is that having reference to the cleansing and reinstating of our filters at Battersea and Hampton. The vigorous prosecution of this work has necessarily added very materially to revenue expenses, and has consequently reduced, to a certain extent, the money available for dividend. This burden should never have occurred, but the directors have to be more or less guided by the advice tendered them from their professional departments; and when I tell the shareholders that the condition of our filters was never, until recently, brought under the notice of the board, they will agree, I think, that the directors are exonerated from any blame for the work rendering necessary such heavy expenditure. This half year the restoration of the filters charged to revenue is £7597, and that is in addition to keeping the filters in fair order. Before completing this work, we have yet to carry out the division and renewing of the largest filter-bed, and to clean and wash out one of the smaller ones. I have no doubt this will extend into the spring of the ensuing year. Looking to the fact that there is already at suspense account £28,778—bills we never knew of until Mr. Quick was going—your directors considered the better way would be to clear off these extraordinary revenue charges at once, although it depreciates the dividend for the time being; but they believe it will sooner place the concern in a better condition. In connection with the reinstating of the filters, I may state that Dr. Tidy, in his analyses, reports that the water supplied by the company is becoming everything that can be desired; and I need hardly add that, as regards quantity, the great decrease of complaints shows of itself that improvements have been effected. During

the last Camp meeting at Wimbledon—generally an excessively trying time for us, occurring in the summer—not a single complaint was made to this company either from the Camp meeting or the town of Wimbledon, because hitherto, when we satisfied the one we deprived the other of its proper supply. It is a matter of satisfaction for the directors to call attention to the rapid extension of the district. Within the past year we have laid on 1476 new houses; there have been 148 relays, and we have also supplied water for building purposes to no less than 578 buildings. The charges paid into the engineer's department in connection with these matters alone amounts to £1514, and that without reference to the usual water-rate. We have been further enabled to add considerably to our meter supplies. Simultaneously with the extension of the district, your directors have materially abated the waste of water which had apparently existed for some time past. The district now is closely watched, and during the past year no less than 15,000 houses have been inspected by your surveyors, and in the greater number of these the fittings have been adjusted, the remainder still being under the notice of the inspectors. As already stated in our report, your revenue this half year suffers by these extraordinary payments, which never should have come out of revenue. There is "Harvey and Co.," from the suspense account, £4000, and the Battersea land £2000. All the bills had really been paid up, and there were no outstanding ones; but we had had lately a bill from a stonemason for paving as far back as 1873, and that amounts to £182. Why that was kept back I cannot tell you. Then there is restoration of filters, £7597. There is another item upon which I wish to say a word. Our turncocks, of course, are always charged against revenue. Besides the turncocks, we have for every turncock a deputy, or ground workman. It has been the habit in this company to charge the turncocks to revenue, but the ground workmen have always been charged to capital, as it was the habit in former days to stick everything possible to capital, and to divide all the money that could be done; but the Government auditor said distinctly, "You have no right to charge your deputies to capital, and I shall disallow it." Therefore, there is a sum of £1500 a year on revenue, which you have hitherto enjoyed, cut away from you at a single stroke. These amounts come to £14,552, which you ought to have received as dividend. We point, however, with satisfaction to the reduction in the consumption of coal, which amounts to a saving of 1500 tons, and it is our hope to effect a yet greater reduction. That will represent an average of about 13s. a ton. You are all aware that the Metropolitan Board of Works have applied to Parliament for power—firstly, to purchase the Metropolitan Water Companies; and, secondly, to establish new and independent works for a supply of water for fire extinction and for drinking. This latter scheme will not only cost some millions of money, and add an increased charge to the present water-rate, but it will involve the opening and disarranging of the whole thoroughfares in the Metropolis, and cause intense annoyance to each individual householder in laying on the new additional supply. Being anxious to avoid what must be a great and necessarily heavy revenue expense in a parliamentary contest, without having first ascertained the wishes of the shareholders, we shall take an early opportunity of learning their opinion whether, under the circumstances, we should act jointly with the other companies, or whether we should take an independent standing. On this point we must necessarily take the advice of our solicitors. The concluding matter to which I have to call your attention is one of a very painful nature. In the advertisement convening the meeting, your attention is directed to the question of rescinding, or the variation, of the resolution of the proprietors, passed on June 20, 1875, for the payment of a retiring allowance to Mr. Charles Robinson, the late secretary of the company. Mr. Robinson was secretary up to January, 1875; he then resigned, and at the following general meeting, in June, the proprietors awarded him a retiring allowance of £300 per annum. It is nothing new to you to hear that the affairs of the company in times past were seriously neglected, and bearing in mind that Mr. Robinson was secretary during this period of neglect, the board have thought it prudent to withhold the payment of Mr. Robinson's pension for the last three quarters. We propose to suspend his superannuation until the action now pending has been concluded, and the board therefore feel bound to ask the proprietors to confirm their action in this respect. Your directors are not in a position, without prejudicing the case, to offer the shareholders any further explanation of this matter; but as the granting of the superannuation was the act of the shareholders, so the board now ask that its deferment shall be either confirmed or that you will order the payment to be made. I move that the report of the directors submitted to this meeting be received and adopted.

Mr. C. M. Vialls seconded the resolution.

Mr. Sturge said he had heard nothing with reference to the Nunhead works, which were finished about twelve months since, and cost a very large sum of money. The interest of that money was lost because nothing was done there, and they were also led to expect that a large outlay might be necessary to secure the reservoir. With regard to the late secretary, he did not propose to ask any questions, but had full reliance on the discretion of the directors. He presumed the directors considered Mr. Robinson had been so much at fault in connection with the former engineer of the company, that they had a right to look for something either from him, or to say that he was unworthy of a pension.

The Chairman said that when the present engineer was appointed and took charge, he asked the board not to call upon him to find fault with the works of his predecessor, but to employ Mr. Bateman to make a report. Mr. Bateman made a report, and said most unquestionably, "Don't put water in the reservoirs as they are at present." It was not thought prudent to take steps to re-make the Peckham reservoirs during the winter months, and, therefore, they remained just as they were when the engineer left. When the late secretary was forced to resign, the directors knew of a good deal which should never have occurred; but they really felt compassion for a man who had lost his eyesight while in their service, and they gave him a pension of £300 a year, though he (the chairman) distinctly stated that he did not deserve it. Further facts had come to their knowledge, and now the directors thought the company should delay paying his superannuation until Mr. Quick's action was settled. However, if the shareholders decided to continue the payment, the directors would do so.

Mr. Soden asked if the board had received any letter from Mr. Robinson since the advertisement convening the meeting appeared in the newspapers.

The Chairman said they had received several letters, one as late as that morning.

Mr. Soden thought they must support the directors in the action they had taken; but, at the same time, it must be remembered that the annuity of £300 a year came as a recommendation from the board to the proprietors.

The Chairman said that Mr. Robinson's friends wished to give him £700 a year, but the directors, as a compromise, recommended £300 a year. They thought it would be tempering justice with mercy.

Mr. Sturge said all the directors asked was to suspend any action on this subject until the result of certain law proceedings had been arrived at, which would have some relation to their late secretary, and he hoped the proprietors would be willing to do so.

Mr. Soden asked that the resolution granting the pension should be read.

The Secretary (Mr. Jelley) read the minutes with respect to this matter. They stated that it was at first proposed—"That a retiring allowance of £700 per annum be given to Mr. Robinson." After some discussion, it was moved as an amendment that the amount be £500. A further amendment was moved, to reduce the amount to £300, and that was carried. It was then put to the meeting as a substantive resolution—"It is hereby resolved that a retiring allowance of £300 per annum be granted to the late secretary, Mr. Charles Robinson, during his life."

Mr. Baddeley thought this was scarcely a matter upon which the shareholders should be asked to act, either by way of rescinding their resolution or suspending it. Either the company were liable to pay Mr. Robinson £300 a year for his life, or they were not; and the directors must take the responsibility of deciding upon that question. For himself, he had nothing before him to guide him to a determination as to whether they would be justified in suspending or rescinding the resolution. It was a matter on which the directors must take the legal responsibility.

Alderman Knight said that certain additional facts having come to the knowledge of the board, they considered it their duty to suspend the annuity *pro tem.* The shareholders had, by the resolution which had been read, ordered the annuity to be paid. It was, therefore, the duty of the board to come to them and say, "We have suspended the payment of this annuity; we ask you to have confidence in us, and to approve of the course we have taken. We do not ask you to rescind or annul the resolution, but only to have confidence in us when we tell you that things have come to our knowledge which no shareholder, having the interests of the company at heart, would expect us to state in a public meeting." He could not imagine what reason could prompt any shareholder to ask such a question in the interests of the company. The board did not ask that the pension should be stopped; but said that facts had come to light which, in their judgment, would justify them in asking the shareholders to support their action, and he was quite satisfied that the board would receive that confidence at their hands. He did not mind stating one fact which had come to his knowledge. Mr. Robinson had a son who was supposed to be in the office as a clerk receiving £50, then £60, then £70 a year. That son was all the while a boy at school. Mr. Robinson passed the account, and allowed the company to pay it, his son being brought to the office at the time of the board meetings, so that he might be seen in the office when the directors came.

A Shareholder asked if that circumstance was known to the board when the annuity was granted.

Mr. Sturge said he was present on that occasion, and remembered the two or three divisions upon it; but it certainly was not then known to him that the secretary had obtained £50 a year for his son in that way. If it had been, he should have considered that there ought to be nothing given.

Mr. Soden, as mover of the resolution, said he must distinctly tell the meeting that he was not then aware of the fact which had been now stated.

Mr. Bowden hoped the meeting would not sanction anything which might affect the evidence Mr. Robinson might be called upon to give, either in favour of or against the company, in the pending action.

The Chairman said that the personal evidence of Mr. Robinson would not be required. All the evidence was written in their books. When the board suspended Mr. Robinson's pension, he (Mr. Robinson) placed the matter in the hands of his solicitor, who wrote a letter to the board. They instructed Messrs Bircham to reply to that communication, but heard nothing further in answer.

Alderman Knight asked for a letter written by Mr. Robinson, in which he stated that he could give some information as to the share capital of the company.

While this letter was being searched for,

Mr. Soden referred to the first paragraph in the engineer's report, stating that a screen had been erected across the Hampton reservoir, but it was not erected as a permanent work. He wished to know what had been the cost of that screen. With reference to the £2000 paid on account of the Battersea land, he asked how it came to pass, when an amicable arrangement was made to get rid of the bargain between the two parties, that the company had not only to repay the £6000 deposit, but a sum payable by way of commission, and likewise the purchaser's costs. He did not see how they could have come much worse off if there had been no amicable arrangement at all. Then, with regard to the restoration of the filters, the accounts for the previous half year showed that £4000 was expended in similar work upon which they had expended between £7000 and £8000 this half year. The matter, according to the statement of the engineer, was not yet completed, and would cost more money. He wished to know how much more money it would cost. He was not an engineer, but it seemed to him a rather doubtful sort of policy to spend money in that way. As he understood from the report, when a filter had to be cleaned there was no other area upon which the filtration could be carried on during the process of cleaning the filter. What would be the cost of erecting two small filter-beds at the Battersea works of the size proposed by the engineer, because if those two small beds would not cost more than would be expended in repairing the existing beds, he thought it would be advisable to undertake their formation, especially as the sum expended upon them would be charged to capital account, and not to revenue, and so would be to the advantage of the company if their works were bought up under any purchase scheme that received the sanction of Parliament.

Mr. Manning said, with reference to Mr. Robinson's matter, he thought the shareholders could not do better than leave it to the directors. They would pass a resolution, if the board wished it, to suspend the annuity; but he thought the matter should be left to the directors.

The Chairman: The fact is the meeting, I think, confirms the proceedings of the directors. (Cries of "Yes, yes.")

Mr. Soden said the directors either had or had not just ground for withholding the payment, and of that question they alone were the judges. It was manifestly unfair to cast upon the shareholders the decision of that question, and he protested, as a shareholder, against any such question being put to him, seeing that he had not the grounds before him upon which he could, with safety, act.

Alderman Knight said it appeared that the letter to which he referred was a private letter sent to Mr. Vialls, but it contained a remark to the effect that he (Mr. Robinson) could explain something in their share capital which nobody else could. These were very painful matters; and, looking to the interests of the company, the board ought not to be questioned as to their reasons, and the meeting ought not to have forced from him what they had done. The directors had nothing to fear; but still there were matters which, in the best interests of the company, ought not to be stated in public.

Mr. Vialls said that Mr. Robinson, in the letter he wrote to him, said there was some peculiarity as to the raising of a certain amount of capital, on which he could supply information that would be very useful to the court of directors. It did not seem to be a matter of very great interest. The subject of Mr. Robinson's pension had been discussed more than once at the board, and very keenly divided upon. The final resolution

was only arrived at by a very doubtful majority, if a majority at all, for it was settled, in fact, by the casting-vote of the chairman.

Mr. Bradfield moved—"That this meeting approves of the action of the board of directors as to the suspension of Mr. Robinson's annuity, and authorizes the board to continue the suspension if they think fit."

Mr. Ilsley seconded the resolution, which was agreed to with four dissentients.

The Chairman, in reply to the question about the screen at Hampton, stated that, when their late engineer left them, they had three filters at Hampton and five at Battersea, not one of which was in working order. The Government Water Examiner called attention to the fact that the water they were delivering was unfit for drinking, and insisted upon their re-making these three filters without delay. Whilst they were being relaid, the company could not give the people water direct, from the Thames, and, therefore, put up a temporary screen, which allowed the water to filter through rapidly. Now that the filters were re-made, they kept up the temporary screen as an addition; it took the rough dirt out of the water, and prevented the filters requiring to be so constantly scraped and cleaned. The cost of the screen was £900, and they could not have got on at all without it. Then as to the Battersea land. The Scotch gentlemen, when they bought the land, paid a deposit of £6000. They then asked for certain conditions which were not in the "Conditions of sale." One condition being that, if they were not satisfied with the title, the sale should be rescinded without giving any reasons, the board immediately gave them notice that they did rescind the sale, and tendered them their £6000 deposit. They refused to receive it, and said they would have the land. The board then placed that £6000 at deposit, and told them it was there at their risk. The matter was considered. The board had already paid a commission of £400 for selling the land, and it was arranged that they should keep the interest upon the deposit—about £180—and give the Property Company £1500 to cover their expenses and law charges. Their own legal expenses were £109. With reference to the advisability of using small filters, he said it might have been so if their filters were in working order, but they had never been properly made from the very first. They really were not filters, for instead of the different strata being put in properly, gravel had been thrown in just as it was dug out of the pit. The cost of making two new small filters would be about £7000 an acre, but if those filters had been made, it would not have prevented the company laying out their money upon the old ones. It was not optional with the directors to repair these filters, for the Government Water Examiner in every report he issued stated that the water was not sufficiently and properly filtered, and the board were, therefore, bound to take steps to remedy that defect.

Mr. Soden asked if the £6000 to be expended during the present six months would be all that was required.

The Chairman said that would finish everything.

Alderman Knight said he should like to say a word about the Battersea land. A few years ago he called their attention to the vacant piece of land that they had at Battersea, and wanted to know why it was not sold. The professional advisers of the board informed him that nothing could be done with it. At the next meeting they were told they had sold it for £41,000, and no doubt the shareholders congratulated themselves that they had made a good bargain. When he took his seat at the board he made inquiries into the matter. He found they had 50 acres of land at Battersea, and that the 5½ acres which had been sold for £41,000 included absolutely the whole of the river frontage. What did they think of a professional adviser recommending the directors to dispose of the whole of their river frontage, leaving 45 acres of back land for them to do with as they liked? But that was not all; the 5½ acres sold contained within it the river wall, which they had been compelled to build to embank their land, at a cost of £38,000; so they were to sell 5½ acres of land, with a river wall that cost £38,000, for £41,000. Would they have given him credit for honesty of purpose if he had consented to such a sale when those facts came to his knowledge? (No, no.) They knew who were their directors in times past, but they knew also very well such things as that would not go down with business men. Fortunately for them, the purchasers asked for a better title; they thought the company could not give them a satisfactory title without going to Parliament, and through that they were enabled to get out of the sale, but it cost them £2000 to do so. He asked the shareholders whether they did not think that in throwing up this bargain the board studied their interests. Here they had 50 acres of land with their filter-beds on it; but that land was too near to London to continue the old filter-beds, and one day they must be removed into the country. What would be the value of that 50 acres of land with a river frontage, compared with the value of the 45 acres without any river frontage? Did not they think the board did right in getting out of the bargain, and also that they got out of it very cheaply? With regard to Mr. Soden's remarks upon the construction of two extra filters, such a plan would simply have been what he should term dodging their responsibility, because they would have been leading the public to suppose that they were filtering properly when they knew perfectly well that the rest of their filters were not worth calling filters at all. They might have made two new filters and have put the expense to capital, but they would have known that they were gulling the public all the while, and were giving them water passed through improperly constructed filters. The money had been expended not, as Mr. Soden might have imagined, in renewing filters, but in constructing them as filters ought to be constructed, and for which they had previously paid; that was why the Government auditor would not let them place it to capital; he said, "No; if you have been so blind as to allow yourselves to be duped in this matter, you must not charge it to capital." He could not have sat at the board and have been a party to leading the public to think they had acres of beds doing filtering work, when he knew they were doing no filtering work at all. If they had a filter two or three acres in extent, and had to clean it, they would, of course, stop their filtering power to that extent; but if they had filters from one-half to one acre in extent, to clean them one at a time they would only stop a small portion of their filtering power. Therefore it was much better to have filters of a smaller area.

Mr. Bowden said he should like to ask if the engineer had had any professional assistance in dealing with the filters. He had heard from gentlemen well acquainted with these things that the whole thing was wrong, and that it might have been set right for a much smaller sum.

Mr. Manning inquired if the board had any information to give as to Richmond.

The Chairman said the Richmond people had now leased the meadow close to the Thames, into which the water filtered from the river, for five years. That would show that the engineer of the company was right when he said they would never get water from their well.

Mr. Manning: They won't come back to us.

The Chairman: They do not show any signs of doing so. We—that is, the London companies—are not allowed to take water below Teddington Weir; but the Richmond people, not being a Metropolitan Water Company, are allowed to do so.

Mr. Wyatt asked whether any attempt had been made to obtain Parliamentary powers to supply Richmond with water. He was instrumental in obtaining the sanction of the Government to the placing of a reservoir in Richmond Park for the company, but he never heard how it was that that privilege was never exercised by the company. There could be no question it must be a very valuable constituency for them to secure. He should like to know why they abandoned that attempt. It was a very valuable district; every facility was afforded by the Government, and why that privilege so granted was abandoned he had never been able to ascertain.

The Chairman said it was in their late engineer's time. Directly the Richmond people said, "We will make water-works of our own," their scheme being to have a reservoir in Richmond Park, immediately they, under the advice of their engineer, said, "We will go and make the reservoir in Richmond Park; we will make works for you, and then, if your well answers, we will pump you well water. If it does not answer, we will continue our supply of river water." However, the Richmond people would hear nothing. Mr. Wyatt was wrong in stating that they got leave, for the answer was, "You do not want the reservoir, because the new people have got leave to make it." However, they made an application for an injunction to prevent the Richmond people from making their water-works, but Vice-Chancellor Malins refused to grant it. There was, therefore, no good in making the reservoir in the park.

Mr. Wyatt said a Court of Equity would not grant an injunction to restrain applications to Parliament. The doors of Parliament were open to any one who chose to petition, and the company having petitioned Parliament for the requisite powers to enable them to supply Richmond, and it having been stated that it was essential that they should have power to construct a reservoir in the park to enable them to furnish that supply, and a conditional permission having been granted, he never could understand why they did not persist in their application to Parliament. The fact of a few active gentlemen in Richmond wishing to exact unfair terms from the company was no reason why they should not submit the question to Parliament, where it would have been thoroughly investigated, and there was such a crying necessity for a good supply of water to Richmond, that, if they had their schemes properly matured, being in a position to show that the Government would sanction the construction of a reservoir, they ought to have persisted in submitting the case to Parliament.

The Chairman said the board acted on the advice of Messrs. Bircham, their solicitors, that, the Vice-Chancellor having refused to grant an injunction to restrain the Richmond people, this company would very likely not have been successful if they had persevered with their Bill.

Alderman Knight said the company had spent £60,000 in supplying Richmond with water, and now the Richmond people snapped their fingers at them, and they could not touch a pipe. He hoped the company would never again allow one penny of their money to be spent in a district that was not included in their parliamentary powers.

Mr. Baddeley asked how it was there were outstanding tradesmen's accounts owing to the amount of £18,000 In addition to this there was an item, "Temporary loans and interest, £27,178." Bad debts were put at £704, which was an excessive amount. He said he had been lamentably disappointed with the report. What was the state of the company? They were upon the eve of one of the most serious parliamentary contests that water company interests had ever known, and, although many companies might be able to present a clean bill of health, they were met with Mr. Rumble's report, for which he was entitled to their best thanks, denouncing a state of things existing in the company which it was hardly possible to conceive. If a committee of the House of Commons were to take the report paragraph by paragraph, they would decide that the Southwark and Vauxhall Company were unable or unfit to supply the public with water, because they really could not manage their own internal affairs. Under these circumstances it behoved them very seriously to look not only to the affairs of the company, as affecting themselves, but as affecting the general water interests. To have any success in Parliament, they must unite with the other companies to support the general interests of the water companies, although there might be a blot on their escutcheon. If they entered into a separate opposition, they would have their separate parliamentary expenses to pay, whereas if they threw in their lot with the other companies, they would only bear, *pro ratâ*, their portion of the expense. He therefore thought it was much better to go hand and glove with their other friends, and fight this battle. If the parliamentary committee laid down a certain principle that the company were only entitled to a certain number of years purchase, then they would import an element into the consideration which would redound much to the discredit of the former board of management, and to the detriment of the widows and children who had invested in the company. There was one paragraph in the engineer's report which struck him as being singular. He hoped it was quite an exception that engineers were obliged to praise their employers for the interest they took in the works. "Your periodical visits to the several pumping-stations and portions of the district during the past year will the better enable you to control expenditure, and appreciate the improvements already effected." He maintained it was the duty of the directors to be constantly visiting the stations connected with the company. They could not in the board-room tell what was going on at the different stations; and if they could not all, as a board, visit each station, they could, at any rate, depute some member of the board to visit the stations, and bring up the report at succeeding meetings. If the directors had been in the habit of visiting the offices on occasions other than the regular board meetings, such a proceeding as that referred to by Alderman Knight, with reference to the son of their late secretary, could not have been carried on.

The Chairman said that, in considering the outstanding accounts, they must not forget that there was a revenue already due for the half year amounting to £76,000. The temporary loans, which were £27,000, had been reduced to £17,000; and as for the bad debts, he thought the amount of £704 was not excessive out of an income of £74,000. He believed that their collectors did their duty thoroughly. Their collection used to cost them £2200 a year. They now had taken up one of the cleverest of the collectors, and appointed him as supervisor, the expenses of that department being £400 a year. The collection cost them £1600, so that the total expense was now only £2000. With reference to the parliamentary contest, it was not simply a question of joining the other companies. There would be two Bills, one in which the whole of the eight companies would unite, and divide the expense according to their capital, which was hardly a fair way. Their own company possessed the third largest capital, but their profits were the worst of any company. They, however, would have to employ counsel, especially to defend their private interests. As to visiting the works, he might say not only did the directors constantly visit the works, but some of them were always there. He, for his own part, was generally there once or twice a week.

Mr. Manning inquired whether the board would be able to pay the dividend of 2 per cent. without borrowing money for the purpose.

The Chairman said he quite expected that they could do so. This was now the time of year when money was coming in rapidly.

In reply to Mr. French,

The Chairman stated that Wimbledon was not in the parliamentary district. The rental was £2700, and the outlay had been £14,000. The directors were aware that the Wimbledon Local Board were making

inquiries with reference to purchasing land and supplying themselves with water. The Lambeth Company had parliamentary rights over the whole of Wimbledon, and they (the Southwark and Vauxhall Company) had an arrangement with them. The directors had bought 31 acres of land at Hampton, and another company had also bought 38 acres of land, at a price of about £400 an acre. They had taken no steps with reference to moving their works. If a customer could be obtained who would give them £10,000 an acre for the land at Battersea, on which the works were at present situated, they would be very glad to move them to Hampton.

Mr. Bowden asked for information respecting the districts supplied by the company outside their parliamentary limits.

Alderman Knight said the information could be supplied to the honourable shareholder on inquiry in the office.

The Chairman gave some figures respecting the outlay at Richmond.

Mr. Wyatt protested against any further expenditure outside of their parliamentary powers, where they were entirely at the mercy of the local authorities. He also suggested whether it would not be wise to apply to Parliament at a very early period for the purpose of legalizing their past proceedings in this respect, representing, as they did, hundreds and thousands of pounds. If they delayed the application until some one else was in the field, their difficulties would be largely increased.

Mr. Vialls said that in almost all cases, during the time he had been on the board, the extensions beyond parliamentary powers had been absolutely forced upon the company, either to prevent the creation of new water companies or for some other urgent reasons, and they had never been undertaken without the sanction of the body of shareholders at a general meeting.

Alderman Knight said the only question upon which the companies could unite in the forthcoming parliamentary contest was as to whether their several undertakings should be handed over to some municipal body. Each company must be represented on its own account, so that in the event of a transfer being considered desirable by the Legislature they might be able to get the best possible terms for their shareholders. Parliament had, however, to consider whether at the present time there was any municipal body in the Metropolis capable of undertaking such a trust, and, for his part, he did not think Parliament would say that there was. He believed they would never trust the Metropolitan Board of Works with it.

Mr. Wyatt said he did not agree with Alderman Knight in the policy which he had suggested, and for this reason—that if the companies did not act unitedly, they might be at cross purposes in submitting their case to the committee. The case of one company was the case of all, and, in his humble judgment, there ought to be a combination; instead of having a multitude of counsel to represent the different companies, they ought to have counsel to represent their common interests. As to the particular question of price, that would be entertained by the committee; but if the principle was conceded, it would have to be settled afterwards by arbitration. The principle the committee would have to determine was whether the Metropolitan Board of Works should have compulsory powers to take the property of the water companies. If each company were represented by its own counsel, they would not be allowed to go into details and say Southwark are so-and-so, and Lambeth are so-and-so, and the Grand Junction have certain privileges. The committee would not listen to that. What they would consider would be whether this property should be taken from the companies compulsorily. He quite agreed with Alderman Knight that Parliament would not give the control of this matter to the Metropolitan Board of Works. He believed the object of the Board in bringing forward their Bill was to compel the companies to give a constant supply, and to subject them to all kinds of pains and penalties, not caring one jot whether such a proceeding entailed an onerous and unjust expenditure upon them. So far as their own board were concerned, he thought they were most happily represented. They had shown an amount of zeal which must necessarily secure the confidence of the shareholders. They were the executive; they knew all the details of the case; they were advised by one of the ablest solicitors in the profession, and a most experienced man; and, having his aid, he suggested the matter should be left entirely in the hands of the board.

The Chairman: Mr. Wyatt has kindly said you may safely leave this matter in the hands of the directors. I think you cannot do better than accept Mr. Wyatt's suggestion, and leave this matter in their hands.

The resolution adopting the report and accounts was then agreed to.

The resolution declaring the dividend having been proposed and seconded,

Alderman Knight said it was very hard on the directors that 4 per cent. of what they had earned should go to pay for the shortcomings of previous management. They had actually earned 6 per cent., and could only pay 2 per cent. Through all this he had great confidence in the undertaking, and he believed they would yet make this an 8 or 10 per cent. company. If the undertaking had not been innately good, it must have been in bankruptcy years ago; but their district was so extensive, and the increase so rapid, that he saw his way perfectly clear to make this a good 7, 8, or 10 per cent. company. He therefore asked them not to be disappointed because they only got 2 per cent. now.

The resolution was then agreed to.

The retiring directors, Mr. Noel Whiting, Alderman Finnis, and Alderman Stone, were re-elected, and Mr. J. Young was re-elected auditor.

The meeting was then made special, for the purpose of consolidating 700 new ordinary No. 1 shares into ordinary stock.

The advertisement having stated that the question of Mr. Robinson's pension would be considered at the "special meeting," the resolution already passed was, *pro formâ*, moved, seconded, and agreed to.

A vote of thanks to the chairman and directors brought the business to a close, the meeting having lasted nearly three hours.

GRAND JUNCTION WATER-WORKS COMPANY.

The following Report was presented by the Directors to the Meeting of Shareholders on the 12th inst.:—

Gentlemen,—Upon meeting you on this occasion your directors believe they may sincerely congratulate the proprietors of this undertaking upon a marked revival in their financial position, and in the prospects of the company, which, they must confess, has more than fulfilled their own sanguine expectations.

Upon the 14th of August in last year the then somewhat unsatisfactory financial condition of your affairs, as declared, after due examination, by the Government auditor, was laid before the proprietors.

Your new board of directors was fully constituted only on the 9th of October following.

One of the most imperative duties of the new direction was evidently to diminish, at as early a period as possible, the very large sums which had been left unpaid of Messrs. Harvey's accounts, or which had been charged against the capital instead of against current revenue. Bearing in mind the short time which has elapsed since then, the following statement will show you how this duty has been performed.

Among the revenue charges in the present financial statement you will find a further payment of £12,500 in reduction of that account. Add to this the previous amounts discharged, and it will appear that a total of £47,581 has, upon the 30th of September last, been set right, leaving only £7500 still in abeyance and to be made good out of a gross debit of £55,081.

In addition to the £47,581 abovestated, all the back claims of other firms, amounting to about £2400, have been entirely cleared off.

It is, at the same time, gratifying to state that the revenue has been steadily progressing. The increase for the year ending at Michaelmas last has been £3152 7s. 2d., while the expenditure for the same period will be found to be lower than that for the previous year.

As a result of all these favourable circumstances, brought about by anxious care and attention to the interests of the proprietors, your directors may safely encourage you to look forward to a condition of things enabling you, if you think fit, to declare a higher rate of dividend at the next half-yearly meeting of the company.

Your directors are happy to inform you that the company's works of pumping and distribution throughout the district, and at the several stations, are in a satisfactory condition, and are fully equal to the demands of the present large district of supply.

The attention of the court has, however, of late, been called to the important question of the area and capability of the filter-beds at the Kew Bridge works, which are below the standard considered by some authorities as desirable for the effectual filtration of the large supply of water even now required during the London season and the hot months of summer. Measures are, therefore, in contemplation for utilizing some of the spare land at those works for the construction of additional filter-beds.

It has likewise been frequently pointed out by the Government Water Examiner that additional impounding and subsiding reservoirs are much required at Hampton, so as to avoid taking in water when floods prevail.

You are already fully aware that about 30 acres of land were recently purchased expressly for this purpose, but the very limited amount of the present disposable parliamentary capital of the company has hitherto rendered it impossible to carry out works of such magnitude. Your directors have, therefore, found it indispensable to give notice of application to Parliament during the ensuing session for powers to raise further capital, a step of which you will understand the urgent necessity.

The new system announced to you at the last meeting as about to be adopted for the collection of the water rentals in advance, was actually inaugurated shortly before Michaelmas last, and its first results may be perceived in the sum of £1867 10s. 4d. set down in the balance-sheet as received before the commencement of the new half year.

The company are at present continuing to receive gradually increasing amounts in advance, and your directors have every hope that, by a careful and judicious management, the system will, within a reasonable time, establish itself without the creation of any public disapproval.

Your directors have by circular, and by the advertisement convening this meeting, informed you that a vacancy has occurred on the board by John Kelsey, Esq., having ceased to be a director. It will be necessary therefore, before the close of this meeting, that such vacancy should be filled up by the election of some duly qualified shareholder. The following gentlemen have given the required notice to offer themselves as candidates—viz., John Kelsey, Esq., C. M. Vialls, Esq., E. Digby Boycott, Esq., and Major-General J. W. D'Oyley.

Your directors, in conclusion, beg to recommend that a half year's dividend, at the rate of 5 per cent. per annum on the ordinary £50 shares and on the £25 shares of the proprietors of this undertaking, and that interest at the rate of £4 10s. per cent. per annum on the payments made on the new £50 shares created in December, 1872, be now declared, and that warrants for the payment of the same be issued on Thursday, the 10th of January next.

W. F. Higgins, Chairman.

Dr.—Revenue Account, for the Half Year ending Sept. 30, 1877.

Maintenance.			
To Maintenance and repair of impounding and service reservoirs, filtering-beds, works, and pipes, for obtaining and storing of water, including the cost of materials and labour	£141 19 8		
Maintenance and repair of mains, pipes, fittings, meters, and works connected with distribution of water, including the cost of materials, labour, and renewals	2,259 4 5		
Pumping and engine charges, including the cost of coals, wages, &c.	6,515 11 0		
Repairs of engines, &c., at the several works, included in Messrs. Harvey's accounts	12,500 0 0		
Filtration, including the cost of materials and labour	667 16 8		
Salaries of engineer and clerks, and wages of inspectors and turncocks	1,939 0 9		
Amount chargeable to the Norland Estate	274 4 10		
Rents of houses and lands to date	350 10 0		
Thames Conservancy	650 0 0		
Rates and taxes, exclusive of income-tax	3,135 18 6		
		£28,414	5 10
Management.			
Allowance to directors	£405 0 0		
Allowance to company's auditors	84 0 0		
Salaries of secretary, accountant, and office clerks	1,279 16 3		
Superannuations of servants of the company	202 6 6		
Commission to collectors	1,666 4 4		
Stationery, printing, and general establishment charges	589 16 9		
Current law and professional charges	229 10 8		
Official auditor and water examiner	65 8 4		
		4,532	2 10
Amount carried to dividend and interest account		29,430	3 4
Balance carried to next account, to provide for losses		2,500	0 0
		£64,876	12 0

Cr.—Revenue Account.

By Balance brought from former account	£2,500 0 0		
Water-rents charged on unoccupied houses and houses not supplied	£1,844 6 6		
Bad debts	839 11 9		
	£2,683 18 3		
Less recoveries, &c., during half year	771 7 10		
	1,912 10 5		
	£587 9 7		
Half year's water-rents accrued to date of this account	64,196 19 5		
		£64,784	9 0
Rents of houses and lands accrued to date		92	3 0
		£64,876	12 0

Sutton Coldfield Gas Supply.—At the meeting of the Sutton Coldfield Corporation, on Monday, Dec. 10, inquiry was made by Dr. Bodington whether it was intended to take any action with regard to the Birmingham Town Council, who had broken up the Park Road, Sutton, for laying down gas-mains. The Birmingham authorities were, he said, acting in direct opposition to the decision of that corporation, and he wished to know the position of the corporation. The warden replied that from the legal opinion he had obtained he could only state that the Sutton Corporation could not in any way interfere with the council laying their gas-mains. Their best plan would be to sit down quietly. The deputy-steward (Mr. Addenbrook) said that at a committee meeting of the whole corporation it was decided that no action should be taken in the matter at present.

Increased Water Charges at Wakefield.—The Corporation of Wakefield have recently acquired the undertaking of the water-works company, and have at once made a considerable advance in the charges for water, both for domestic and manufacturing purposes. The subject was brought before the meeting of the town council, on the 11th inst., by Mr. Cuthbert, who asked why the charges had been increased, saying that the directors of the company, who were until recently the owners of the works, always managed to meet all expenses and to pay a good dividend to the shareholders. The town-clerk replied that the object of the committee in advancing the scale of charges was to meet the extra expenses which had been incurred by the corporation in opposing the water-works company's Bills in Parliament. The price which the corporation paid the company for their works was so high that the council could not fairly keep the charges for the water at the same rate as before.

AVERAGE METER SYSTEM IN PADDINGTON.

The following report of the General Purposes Committee of the Vestry of Paddington has just been issued:—

"Your committee have pleasure in reporting that the average meter system has now been in operation for a period of three years ending the 30th of September last, and from the accompanying statements it will be seen that the actual saving effected throughout the past year, after payment of inspector's salary and maintenance of meters, governors, &c., has been £818 17s. 2d., or at the rate of 9s. 4¾d. per lamp.

"The work of public lighting in the parish still continues to be carried on in a satisfactory manner, and your committee are now enabled to report that several metropolitan vestries have followed the example of Paddington in respect to burning gas by measurement, &c., and in each case a saving has been effected. (Signed) "J. Flood, Chairman."

Appended to the report of the committee is the report of Mr. George Weston, Inspector of Public Lighting for the parish. It is as follows:—

"Gentlemen,—The 30th of September last was the close of the third year's working of the average meter system and modified hours as applied to the lighting of the public lamps in the parish, and I beg to submit for your information the annual tables. Every matter in connection with the system continues to work most satisfactorily. The addition of £199 16s. to plant and stock account during the year is for improved gas-cocks, in accordance with the recommendation of the Referees, otherwise the expenditure for plant and stock would have been cleared off this year.

Comparative Statement between the Old and New Systems, Showing the annual sums paid for gas, wages, repair of columns, lanterns, and maintenance of meters, governors, inspector's salary, and saving effected.

Old System, 1876–77.

Gas—		
December quarter, 1736 lamps and additions, at £3 14s. 7d. per annum	£1737 1 7	
March quarter, 1742 lamps and additions, at £3 14s. 7d. per annum	1620 7 6	
June quarter, 1747 lamps and additions, at £3 14s. 7d. per annum	1626 2 10	
September quarter, 1742 lamps and additions, at £3 14s. 7d. per annum	1626 9 0	
		£6610 0 11
Lighting—		
December quarter, 1736 lamps and additions, at 14s. 6d. per annum	£314 0 4	
March quarter, 1742 lamps and additions, at 14s. 6d. per annum	314 14 10	
June quarter, 1747 lamps and additions, at 14s. 6d. per annum	316 2 10	
September quarter, 1742 lamps and additions, at 14s. 6d. per annum	316 4 2	
		1261 11 2
Repairs, painting, &c.—		
December quarter, 1736 lamps and additions, at 3s. 6d. per annum	£75 18 1	
March quarter, 1742 lamps and additions, at 3s. 6d. per annum	75 19 5	
June quarter, 1747 lamps and additions, at 3s. 6d. per annum	76 6 2	
September quarter, 1742 lamps and additions, at 3s. 6d. per annum	76 6 6	
		304 10 2
		£8176 2 3

New System, 1876–77.

Gas—		
December quarter, meter average, 1736 lamps	£1914 2 6	
March " " " 1742 "	1662 15 0	
June " " " 1747 "	875 1 6	
September " " " 1742 "	1060 15 0	
		£5512 14 0
Lighters wages—		
December quarter	£320 16 0	
March "	293 15 6	
June "	341 0 6	
September "	316 11 0	
		1272 3 0
Repairs and maintenance of meter-boxes and governors, lamp-columns, painting, &c.—		
December quarter	£104 18 9	
March "	105 4 7	
June "	105 16 3	
September "	105 8 1	
		421 7 8
Inspector's salary—		
December quarter	£52 10 0	
March "	52 10 0	
June "	55 0 0	
September "	55 0 0	
		215 0 0
		£7421 4 8
Deduct cash received for private lighting	£38 5 0	
Ditto from sewer-rate account for gas at urinals	25 14 7	
		63 19 7
		£7357 5 1
Saving effected under the average meter system and modified hours, during the twelve months, to set against expenses, stock, and plant		818 17 2
		£8176 2 3

Memo.—£818 17s. 2d. ÷ 1741¾ lamps, being the yearly average number = 9s. 4¾d. gain on each lamp throughout the parish.

Expenses Account for Three Years ending Sept. 30, 1877, Consequent on working the Average Meter System.

Sept. 30, 1875—		Sept. 30, 1875	
Expenses and tradesmen's bills, as per statement of first year's working	£389 5 0	First year's gain	£622 8 11
Sept. 30, 1876—		Sept. 30, 1876—	
Expenses and tradesmen's bills, as per statement of second year's working	83 16 11	Second year's gain	678 12 7
Sept. 30, 1877—		Sept. 30, 1877—	
Expenses and tradesmen's bills, as per statement of third year's working	81 16 4	Third year's gain	818 17 2
Balance carried to credit of stock and plant account	1565 0 5		
	£2119 18 8		£2119 18 8

Stock and Plant Account.

Sept 30, 1875—		Sept. 30, 1877—	
Stock and plant, as per former statement, to date	£1455 17 8	Balance from expenses account, to date	£1565 0 5
Sept. 30, 1876—		Balance yet to clear off for outlay on stock and plant	193 13 2
Additional, as per statement, to date	26 1 7		
Sept. 30, 1877—			
Additional, as per statement, to date	276 14 5		
	£1758 13 7		£1758 13 7

Comparative Detail of Hours and Consumption of Gas for One Lamp, *From September, 1876, to September, 1877.*

Table showing the hours of burning, and the amount the vestry would have paid the gas company under the *old contract system* for gas at £3 14s. 7d. per lamp per annum, or 3s. 6d. per 1000 cubic feet.

Months.	Hours Burning per Month.	Average Hours per Night.	Rate per Hour.	Quantity of Gas Consumed.	Cost per Month, Gas being 3s. 6d. per 1000 Cubic Feet.
1876.	Hours.	Hours.	Cub. Ft.	Cubic Feet.	S.
October	409·8	13·21	5	2049	7·17
November	450·0	15·00	"	2250	7·87
December	494·8	15·96	"	2474	8·65
The quarter	1354·6	..		6773	23·69
1877.					
January	478·8	15·44	"	2394	8·37
February	417·2	14·38	"	2086	7·30
March	369·8	11·92	"	1849	6·47
The quarter	1265·8	..		6329	22·14
April	299·0	9·96	"	1495	5·23
May	254·8	8·21	"	1274	4·45
June	220·0	7·33	"	1100	3·85
The quarter	773·8	..		3869	13·53
July	240·8	7·76	"	1204	4·21
August	288 8	9·57	"	1444	5·05
September	337·0	11·23	"	1685	5·89
The quarter	866·6	..		4333	15·15
	Hours.	Hours.	Cub. Ft.	Cubic Feet.	S.
The year	4260·8	11·66	5	21,304	74·56

Table showing the actual hours of burning, &c., and the amount the vestry has paid the gas company for gas per lamp per annum under the *new system*, gas being 3s. 6d. per 1000 cubic feet.

Months.	Average.		Estimated Consumption at 5 and 4·6 Cubic Feet per Hour.	Actual Consumption by Meter Average and Modified Hours.	Difference Gained by Meter.	Consumption per Hour.	Total Quantity Gained between Old and New Systems.	Actual Cost per Month per Lamp for Gas at 3s. 6d. per 1000 Cubic Feet.
	Hours Burning per Month.	Hours per Night						
1876.	Hours.	Hrs.	Cubic Ft.	Cubic Ft.	Cub. Ft.	Cu. Ft.	Cubic Ft.	S.
October	377·83	12·18	1889·15	1805·91	83·24	4·77	243·09	6·320
November	423·5	14·11	2117·5	1969·66	147·84	4·65	280·34	6·893
December	460·58	14·85	2274·41	2101·59	172·82	4·56	372·41	7·355
The quarter	1261·91		6281·06	5877·16	403 90		895·84	20·568
1877.								
January	457·75	14·78	2240·56	2064·00	175·66	4·51	329·10	7·227
February	361·50	12·91	1752·25	1630·38	121·87	4·51	455·62	5·766
March	390·08	12·58	1881·52	1772·08	109·44	4·54	336·92	6·202
The quarter	1209·33		5874·33	5467·36	406·97		1121·64	19·135
April	248·33	8·27	1190·80	1134·13	56·67	4·56	100·87	3·969
May	208·15	6·71	992·41	944·99	47·42	4·53	289·01	3·307
June	171·40	5 71	817·57	788·24	29 33	4·59	311·76	2·758
The quarter	627·88		3000·78	2867·36	133·42		701·64	10·034
July	193·08	6·22	908·37	902·24	6·13	4·67	301·76	3·157
August	256·18	8·26	1207·58	1201·85	5·73	4·69	242·15	4·206
September	301·55	10·41	1433·79	1369·39	64·40	4·49	315·61	4·792
The quarter	753·81		3549·74	3473·48	76·26		859·52	12·155
	Hours.	Hrs.	Cubic Ft.	Cubic Ft.	Cub. Ft.	Cu. Ft.	Cubic Ft	S.
The year	3852·93	10·58	18,706·91	17,685·36	1020·55	..	3578·64	61·892

Defects of Unmetered and Metered Lamps, *For the Twelve Months ending Sept. 30, 1877.*

	Unmetered.	Metered.
Knocked down and out of lighting	24	5
Escape in columns, or defective stand-pipe	40	1
Out of lighting all night—		
Water	8	—
Naphthaline	—	—
Stoppages in services	26	3
Out of lighting part of night—		
Water—out	73	10
" bad	74	20
Naphthaline—out	269	19
" bad	1189	84
Stoppage in services—out	7	2
" " bad	30	—
Cocks turned off in the night	258	15
" on at lighting time	5	12
Lights blown or knocked out, and gas escaping	802	47

"The gas company have been served with notices, and rectified 109 defective service-pipes during the twelve months, at their own expense.

"Herewith I also beg to hand the quarterly accounts, amounting to £1205 6s. 3d., which includes the supply of gas to all the public lamps.

(Signed) "George Weston, Inspector."

Gas Explosion at Manchester.—Last Monday week, an explosion of gas occurred at the warehouse of Messrs. I. J. and G. Cooper, Church Street. When the warehouse was closed on the previous Saturday, the gas was turned off at the meter, and on Monday morning, when it was turned on again, there was a considerable escape from the pipe in a small office adjoining the entrance. The porter tried to detect the place of leakage with a lighted taper, and whilst he was so engaged the explosion occurred. The furniture of the office was smashed, and the windows were blown out. The porter was thrown down and cut about the hands and face, and was taken to the Royal Infirmary. It is believed that the gas-piping had been damaged by rats, and the leakage arose accordingly.

YORK CITY COUNCIL AND THE GAS COMPANY.

At the Meeting of the York City Council on the 5th inst.—Alderman MELROSE in the chair—the question of the proposed application to Parliament by the York United Gas Company for additional powers came up for consideration.

Mr. COWLING moved, in accordance with the recommendation of the Urban Sanitary Committee, that a special committee of the council be appointed to consider the application of the company, and to report thereon.

The TOWN-CLERK read a memorial, signed by between 180 and 190 persons, describing themselves as the owners and occupiers of premises situated in the north-eastern parts of the city, requesting the council to take into consideration the intended application of the gas company to Parliament to enlarge their works and extend their district of supply. The memorialists submitted that the present works of the company in Monkgate were, and always would be, a most offensive and grievous nuisance to the occupiers of that extensive and populous district, and to all persons daily and nightly passing and repassing; that they were alike injurious and detrimental to person and property, and had already been too long permitted to remain on their present site. The memorialists, therefore, suggested that the proposed Act should be strenuously opposed in Parliament by the council, and that the gas company should be required to remove their works to some site at a considerable distance from York. They also requested the council to take such steps as were expedient for effecting those two objects.

Mr. CONING said there could be no doubt that it was of great importance that the interests of the city should be carefully watched in connection with the Bill for increased powers which the gas company were promoting. With regard to the memorial and the suggested removal of the works, he asked where the money was to come from to compensate the gas company for their removal. It seemed to him that the minute submitted by the Urban Sanitary Committee was a little vague in its character, and he argued that they should define the precise power of the committee. There were three points which the committee ought to keep steadily before them. The first was, that any extension of the plant of the company should be considered with reference to the interest of the contiguous property; in the next place, they ought to take care that the dividend payable on the new capital should be considerably lower than 10 per cent.; and, in the third place, they should take care that, as the extension of the mains to villages miles away from the city would involve considerable outlay, and would not, perhaps, yield a satisfactory dividend, the amount of dividend to which the shareholders were entitled was not provided at the expense of the consumers in the city.

Mr. JOHN BROWN agreed with Mr. Coning's remarks concerning the suggested removal of the gas-works, and proceeded to say that the gas company had served the interests of the city in a remarkable manner; and inasmuch as the gas was supplied to consumers at an exceedingly low price, the council should acknowledge that the gas company had managed their affairs very well, and give them every assistance they could. Alluding to the question of increased capital and that of dividend, he expressed an opinion that the rate of dividend should not be greater than 7 per cent.

Mr. WILKINSON was in favour of the appointment of a committee to watch the Bill, but had no sympathy with the feeling which existed in the council on the part of certain individuals—a feeling of unreasoning prejudice and hostility towards the gas company, which had been manifested on all occasions in harsh judgments upon them, and in the absence of fairness whenever their affairs were brought forward publicly. The company provided the city with fairly good gas, at as low a price as any other company in the kingdom, and their works were carried on with as little nuisance as any gas-works could be. He thought it would be unwise of the council, by nominating a prepared select committee, to put themselves in an attitude of hostility towards the company, who ought to be treated as any other citizens about to erect a manufactory—with consideration, fairness, and perfect justice. If they harassed the gas company, and hindered them unfairly in any extensions of their business, and if they drove their works out of the city, the increased cost in the manufacture of gas which that would entail would not come upon the shareholders, but upon the consumers, whom they ought to protect.

Mr. CRUMMACK said Mr. Wilkinson seemed to consider the committee which had been nominated were arbitrarily and strenuously determined against the gas company. In forming the committee, not a word was said as to what they should do, except that they were to be a committee to take charge of and watch the company's Bill in its progress through Parliament.

Mr. WILKINSON said that Mr. Cowling had asked him to serve on the committee, but he objected if the purpose of the committee was to harass the gas company.

Alderman MARCH remarked that the only object of the council was to protect the city against any undue influence that might be brought to bear upon it by the Bill. He had no personal feeling against the gas company, nor did he believe any one else had, and, in his own opinion, they had made the best selection possible.

Alderman CHARLTON thought it right that the committee should understand the feeling of the council with regard to the dividend to be paid on the new capital. His opinion was that the dividend should be restricted to 5 per cent.

The TOWN-CLERK pointed out that if the Bill was laid before the committee, the committee would then see what the company proposed to do in that respect, and if the future dividend would be unfair to the citizens they should so report to the council.

Mr. RYMER called attention to the fact that the gas company proposed to purchase a piece of land by the side of the Foss, which in winter was generally flooded, and which he thought was detrimental to health. They would have to raise that land, and they would thus remedy some nuisance.

The committee were then appointed.

HASTINGS GAS SUPPLY.

At the Meeting of the Hastings Town Council, on Friday, Dec. 7—the MAYOR (Alderman Howell) presiding,

The Roads Committee, to whom the matter had been referred, brought up a report stating that the deputation of the council had waited upon the directors of the gas company, and that they had urged upon the company the necessity of decreasing the price of gas supplied to the public lamps. The directors informed the deputation that they were quite willing to enter into a contract with the council for five years at 4s. 2d. per 1000 feet of gas, £1 4s. 2d. for cleaning, &c., each lamp, and 10s. for every meter fixed. The committee considered that this arrangement would be less advantageous than the present one, and declined to enter upon it.

Alderman WILLIAMS, in moving the adoption of the report, quoted some statistics to prove that the price of gas should be lower. The town was charged £5 each per annum for the public lamps, which, considering the present price of coal, was too high. The minds of the directors of the company appeared, however, to be made up, and he thought the council should have gas-works of their own.

Mr. VERNON, one of the deputation, complained that the directors were not open to reason, and that the council were still paying £5 per year per lamp, though coal was not nearly so dear as it was some years ago. The council had many reasonable grounds to go upon. It had occurred to him that the council might take the lamps in their own hands, thus saving £200 a year. The result of the interview with the directors was that the latter had offered to supply the lamps at £5 0s. 2d., instead of £5, the present price.

Mr. REEVES said they paid more, privately and publicly, for their gas than other towns on the coast did. He suggested that the lamps should be put out earlier in the morning, and that more lamps should be put in the undedicated roads. He thought the company might have made a concession.

Mr. EATON said that the question had been before the council for years, and the recent agitation was not brought about by the Ratepayers Association. He deprecated the plan adopted by the directors in paying off back dividends, the payment of which, he thought, ought to have been distributed over a long term of years, especially as many of the shares had changed hands. If they had done so they might have charged less for their gas; but they seemed determined to do as they liked.

Mr. BRADNAM said the gas company gave the council to understand that when the price of coal was reduced they would make a decrease in the price of gas.

Alderman GAUSDEN made a few observations as a shareholder. He was sure that the gentlemen who formed the deputation would not unfairly state the result of the interview. It would appear, however, from their remarks, that the directors of the gas company had arbitrarily decided not to make any alteration, and that they did so without the slightest explanation or argument. When the 5s. was put on some time ago, it was understood that it should be taken off when coals had fallen; but the coals had not fallen 20 per cent. since the 5s. was put on. It was argued that coals could be got for 14s. per ton in London; but that was very much under what the Hastings Gas Company paid, whilst the very high price of labour was a most important feature. Then the consumption of gas by the public lamps was greater than the average upon which the charge was based, and the directors had suggested that the fair and proper way of carrying out the supply to the public lamps would be by meter, and that the council should have the gas supplied at 3d. per 1000 feet less than the private consumers. He also mentioned that the company often had to lay down a main in a new road for the purpose of supplying a public lamp.

Mr. WINTER said this was the gas company's day; but a time would come when it would be the 30,000 inhabitants day in the matter of gas. It was too bad that Hastings should pay 4s. 2d. per 1000 feet when it was only 3s. 6d. in London and Brighton. Why could not Hastings have the same privilege? The company had paid the dividends of 10 or 20 years ago at a cost of £5000 or £6000, and the shares had changed hands probably several times. The company had used their power to the utmost, and he should hope that the town would have a new gas company.

Mr. WOOD thought it was a very serious matter; and, referring to what Mr. Gausden had said of the new roads, pointed out that the mains answered the purpose of supplying gas to the houses as well as to the public lamps.

Mr. PICKNELL, a shareholder in the company, said he thought the directors might have yielded a little. He moved that the question be referred back to the Roads Committee for further consideration.

Mr. BURGESS seconded the motion.

The MAYOR said he thought the price of gas ought to be decreased, seeing what large customers the council were to the company, spending about £4000 every year. He suggested that the matter should be fully considered by the council. He advised that the council move for a Bill for a new gas company, in which event the present company would be likely to meet them. He considered that the town ought to have no difficulty in getting up £30,000 or £40,000 to start a new company, which could be worked with half the capital at which the present one was worked.

The motion was adopted unanimously.

CARDIFF GAS SUPPLY.

At the Meeting of the Cardiff Town Council, on Monday, Dec. 10—the MAYOR (Alderman Taylor) in the chair,

A report was presented from the Lighting Committee, which stated that the gas inspector (Mr. J. W. Thomas) had found, as the result of his examinations, that during the month of November the average illuminating power of the gas supplied by the company was 13·82 candles, being a fraction below the parliamentary standard.

Mr. W. SANDERS (chairman of the committee) moved the adoption of the report. From the report of the gas inspector, it would be seen that of seven inspections made during the month of November, on five occasions the gas was found to be below the minimum standard. He drew attention to this circumstance because during the past year the matter had been very carefully investigated by the Lighting and Water Committee. The corporation were not only large customers of the gas company, but conservators of the public interest, and from the rate the corporation and the public paid for gas it was highly important that they should be supplied with a better article. It might have been an accidental occurrence that during the last month there should have been such a poor supply of gas; but during the past year, on inspection, the gas had been below the minimum standard no fewer than nineteen times. Compared with other towns, the price of gas in Cardiff was high. He had been in correspondence with some twenty towns, and the replies he had received justified the statement that Cardiff ought to be supplied with a much better article than they received for the price they paid—viz., 3s. 3d. Other towns obtained better gas for less money. The public lamps in Cardiff were also charged too high in comparison with other places.

The MAYOR said Mr. Sanders was travelling away from the question of the adoption of the report, which contained nothing about these prices.

Mr. SANDERS thought, as chairman of the committee, it was his duty not only to call attention to the facts connected with the bad supply of gas in Cardiff, but to show the reason thereof.

Mr. FULTON seconded the motion. He said it was not an agreeable duty to have to find fault with the gas company or with any other company; but, with these facts before them, they would be neglecting their duty as a corporation did they not call the attention of the gas company to the subject.

The report having been adopted,

Mr. STONE moved that the gas company be summoned under the 19th section of the Cardiff Gas Act, 1870, for not supplying gas of proper illuminating power.

Mr. YORATH seconded the motion, which was supported by Mr. DAVIES.

Mr. JACOBS asked whether it was not necessary that notice of inspection should have been given to the gas company.

Mr. SANDERS said that was only necessary with regard to inspection otherwise than at the company's works. The inspection on the 23rd of November was at the company's works.

Alderman JONES moved, as an amendment, that the whole matter be

referred back to the committee. The statements made by the chairman of that committee had not, to his knowledge, been discussed in committee, and he had never heard those statements brought forward until now. Doubtless the gas was of a low standard quality, for they were entitled to a 14-candle gas, and the company had no right to give them gas of a quality inferior to that. To recover penalties the necessary notice must have been given. The statements made by Mr. Sanders, he repeated, had not been submitted to the committee, and, therefore, they had had no means of testing their accuracy. Very likely they were all correct; but, if the subject were referred back to the committee, by next month an opportunity would be afforded to prepare and bring forward statements which the committee could endorse. It was only fair to the members of the council that the whole of the facts should be placed before them. The matter ought not to have been brought forward in this way, so that nobody could contradict or corroborate the statements made.

Alderman ELLIOTT seconded the amendment. Before taking proceedings against the company, the corporation ought to be perfectly prepared. At the same time he regretted that the company did not give them a better quality of gas.

Mr. ARMSTRONG thought that it would be a pity to lose a month. It would be as well to draw the attention of the gas company to the subject before taking such steps, and tell them certain penalties would follow if they did not supply gas of a better illuminating power. They would very likely effect an improvement.

After some further conversation,

The amendment was negatived, and the motion was carried.

GAS AFFAIRS AT ELGIN.

ADOPTION OF THE BURGHS (SCOTLAND) GAS SUPPLY ACT.

As far back as the month of June last, a special meeting of the Town Council of Elgin was held to consider the propriety of adopting the Burghs (Scotland) Gas Supply Act, when a resolution in the affirmative was agreed upon. Another special meeting was recently held to resume consideration of that resolution, all the members of the council being present.

Lord Provost CULBARD, who presided, referred to the great importance of the business in hand, and expressed his disappointment at the subject not having been more generally debated in the local press, and by the public; but, from what he knew personally, and from gentlemen who had taken an interest in the matter, he thought the feeling of the town was very much in favour of proceeding to adopt the Act, and of approaching the gas company with the view of transferring the management of the gas supply into their own hands. He preferred to avoid mentioning details, and simply desired to decide the principle—"Was it right or wrong that such things as gas and water should be in the hands and at the command of the community?" The tendency of such undertakings was, he said, to get into narrower hands, and into the hands of people who were less and less interested in the community, whose only reason in the matter became personal, and, of course, selfish. He was well aware that when the Elgin Gas Company started, in the year 1830, many of the promoters showed their goodwill to their fellow-citizens by providing them with a very great desideratum for their comfort. It had turned out, very fortunately for those gentlemen, not, as they anticipated, a losing concern, but a very profitable one. The company started with a capital of £6210, in £621 shares, and during the greater period of their existence dividends of 5 per cent., and latterly 6 per cent., had been paid on the shares. Moreover, it had been so profitable as to induce the company to create bonus additions to the extent of £3726; and now dividends of 6 per cent. were being paid upon £16 instead of upon £10, the original value of the shares. He had been making inquiries as to the sales of gas shares in recent years, and had found that extremely few sales and few transfers had taken place. However, in 1873, ten shares were disposed of at £12 each, and subsequently some shares had been sold at from £12 to £13. He was not prepared to say what was now the proper value of the shares on which interest was being paid as on £16. If the council did not then finally resolve to adopt the Act, they would not get another chance of doing so for other three years, and, by the end of that time, instead of paying a dividend upon £16, the company, by having added more bonuses to the original shares, might be paying dividend on a much higher value, so that it would become more and more difficult to acquire the works. After referring to the financial benefits which the ratepayers had derived in other towns where the gas supply had been taken over by the municipal authorities, as in Aberdeen, Dundee, &c., he proceeded to say that similar circumstances would produce similar results in a town like Elgin, if the transference were managed properly. They wanted only fair dealing. The gentlemen who held the gas shares would try to make the best bargains they could for themselves, and it was the duty of the council to do the same for the public. If the shareholders forced an arbitration it would increase the expense very much; that, however, might be counterbalanced by the natural increment of the town, and by the fact that the gas supply, instead of being a monopoly, would be in the hands of the consumers. He concluded by moving the adoption of the Act.

Bailie NICOL, in seconding the motion, said that he was at the first a good deal against the adoption of the Act; in the meantime, however, he had read up the Act, and got further information, and he now thought it much better, instead of "putting back the clock" for three years, to proceed at once to adopt the measure. The council, representing the public, would go about the transference of the gas company's property in a fair and honourable way, indulging in no "humbug," but doing everything clean and above-board.

Some conversation then took place between Treasurer MACDONALD, the LORD PROVOST, and the TOWN-CLERK, regarding the extension of the works of the gas company, the creation of additional capital in the shape of bonuses, and the altered value of the shares, the treasurer remarking that often a fictitious value was put upon shares, though he would not say that it was so in the case in question.

Mr. DUNLOP made a long speech on the subject. He was ready to consider any proposal to acquire the gas-works for the town on fair and equitable terms, clearly defined, such as by paying a lump sum, or so much per share; and he would prefer a mutual arrangement between the gas company and the town council, rather than an arbitration, which was a very expensive mode of settlement, and very often turned out to be unsatisfactory. From his reading of the Act, he was of opinion that by adopting it, they would be able, after a number of years, to give cheaper gas to the consumers, providing, of course, that they got the works in fair order and at a reasonable price. However, by the operation of one of the clauses of the Act, they would have to redeem out of each year's revenue one-fortieth part of the borrowed money; and he therefore thought it very unlikely that they would be able to give any reduction for a long time—indeed, he would not be at all surprised if they had to increase the present rate for some years, on account of the clause referred to. He entered into some calculations, from which he argued that they could not well offer more than £21 5s. per share, and he thought that, as the works were old, and as the transfer would cost some money, about £20 per share would be a good offer. He subsequently adduced the case of Kilmarnock, a burgh in which the gas supply had been taken over by the town council, which was about three times the size of Elgin, and as good a place for comparison as any he knew. From the replies to questions which he had put to the manager of the gas-works in that town, he stated that the gas supply of Kilmarnock had been transferred in the year 1872; that the amount of each paid-up share was £25, the dividend then paid by the gas company being 7 and 7½ per cent.; that the town paid £36 for each share, the settlement being by mutual arrangement rather than by arbitration; that the price of gas in 1872 was 5s. per 1000 feet, and the same in 1877; that the quantity of gas made per annum at the time of the transfer was 27 million cubic feet, rising to 38 millions in the present year, the average illuminating power now being fully 28 candles; that, during the first three years, one per cent. had been laid aside each year from revenue as a sinking-fund, rising at the present time to 1½ per cent. on the capital; that the amount of the capital was £46,000, of which £44,000 was raised by mortgage, debentures, and bonds, and £2000 from profits made since the works were acquired. As shown by the balance-sheet, the annual profit derived from secondary products, &c., was—chemical works, £1022 18s. 5d.; meter-rents, £504 14s. 3d.; charcoal, &c., £343 2s. 3d. The manager, in his reply, went on to say—"The reason why gas is still 5s. per 1000 feet in Kilmarnock is, that during the year 1873-74, when the price of coals was so extraordinarily high, we had no power to raise the price above 6s. During that time we charged 5s. 10d., and actually lost money. Other towns of a similar size were then charging 7s. 6d. But for this exceptional rise in coals, our price would, ere this time, have been reduced to 4s. 7d. Next year we fully expect to reduce it to this figure."

After some remarks by several members, and explanations by the TOWN-CLERK,

Mr. SCOTT (a new member of the council) said that the Provost had indicated rather than condescended upon certain details, and had referred to the success of the water as a sort of justification for transferring the gas-works. The two things were so essentially different that no precedent could be made of the water scheme for going on with the gas scheme. Water was a necessary of life, for which it was impossible to discover a substitute. Gas was a manufactured article, and there was a possibility, and even a probability, of the discovery of a substitute for it. After noticing some other points of difference between the two schemes, he referred to what he called an important one, having reference to the maturity of public opinion on the point under discussion. The Provost had said that he had ascertained that public opinion was ripe upon the question; but he (Mr. Scott) had had as good an opportunity, during his recent canvass, of testing that point as any one, and only four persons, out of all the ratepayers who spoke to him, put a question in reference to the gas, thereby showing that there was a perfect apathy in the public mind about it. Another remarkable circumstance about it was that though the provost brought up the question at the nomination meeting, yet, though questions not very pertinent to the affairs of the city were put, not one single question was put in reference to the gas. The fact was the matter had never been discussed in public, and it could not be said with accuracy that the public were in favour of the scheme. A great many persons he knew were against it, and the only four persons who spoke to him about it were all against it. He did not say that, by adopting the Act, they were absolutely committed to purchase; but he said it was not a proper thing to adopt it, and to keep the resolution hanging over the heads of the gas directors.

Treasurer MACDONALD: That is their business.

Mr. SCOTT said no doubt the Act protected them well enough. He subsequently remarked that it was unfair to compare such large places as Aberdeen and Dundee with such a small town as Elgin; besides which, every gas supply undertaking was surrounded by special circumstances, which made it hardly possible for them to judge the one by the other. They must enter upon a detailed examination of each individual case. At a later stage he said that he was not opposed to the transfer of the gas-works; he only wanted information and time to consider the question.

Mr. ORR remarked that when the question was brought up some months ago he was not prepared to take over the gas-works unless he saw that there would be an advantage from it; but the principle that corporations should have gas and water supply undertakings in their own hands was very right and proper, and it was one that had been growing in the country; and he argued that there were points of resemblance, as well as of difference, between the two things; and, as the water supply in the hands of the town council had been a financial success, so also might the supply of gas.

Mr. MITCHELL was strongly in favour of the gas and water supply being taken over by the council; but his fear with regard to the former scheme was the great likelihood of gas being superseded by another agent. However, from the explanations which he had heard regarding the law of the matter, he was resolved to vote in favour of the motion.

The discussion was continued by Bailie BLACK, Mr. JOHNSTON, Dean of Guild GOODWILLIE, Mr. CRUICKSHANK, Treasurer MACDONALD, and other members, after which

Mr. MACKAY said he should also support the Provost's motion, being assured that, if they took over the gas-works, they would have much better gas than they had at present. Just now they were paying 15 per cent. for the use of the old meters. There was not, he thought, another town in Scotland where the rate was so high. In Aberdeen the rate had been only 6 per cent., and now under the council it was much less. He himself had in all paid £10 for the use of his meter. The directors were not content with 6 per cent. for their gas, but must have a larger profit on everything connected with it.

Bailie WHYTE would vote for the motion. He could not see any object in the delay asked for by Mr. Scott and other speakers. They had already delayed for six months. He would not then enter into a discussion on the merits of the question, nor was he prepared to admit in the meantime that he approved of the transference of the gas-works; but when a proper scheme was laid before them he would be prepared to consider it, and to approve of it if it was to benefit the ratepayers. In Inverness, he believed, the transference of the gas-works to the council had resulted in putting the community in a worse position than they were in before. He would not be prepared to go into the question of arbitration at all, and he understood that the gas company were so irritated at what had been said about them that they would not meet them. If a deputation, however, were to wait upon them they might probably look at the matter in a different light.

The PROVOST, in summing up the discussion, said that if they resolved to adopt the Act, they could appoint a committee to go into details in future in committee, or in any way they decided upon. That was the only and proper way that details on a matter of such difficulty and delicacy could be properly dealt with. The matter had now been before the public for seven months, and not one single complaint had been uttered by one single individual against the scheme.

When the question was put to the meeting, five members voted for delay; but they explained that they did not wish to defeat the Provost's motion, their desire being to get delay for further discussion. Eventually, the motion was carried unanimously.

THE MOVEMENT OF WATER IN THE CHALK FORMATION.

By Mr. BALDWIN LATHAM, M.I.C.E., F.G.S.

[A Paper read at the Meeting of the British Association.]

It is a matter of considerable importance to the engineer that he should be able to determine with accuracy the direction of the flow of underground water, as both the volume and quality of the water to be procured at a particular spot in well-sinking depend upon knowing the extent of the contributing area, and the direction of the flow of the water. A very large number of observations have been made by different persons on the relative height at which the water stands in wells in the chalk formation. The Rev. James Clutterbuck, Mr. John Evans, F.R.S., Mr. J. Lucas, F.G.S., the author, and others, have shown by direct measurement that the water in the chalk and other geological formations does not stand at what is termed a water level, and what is known as the water level of subterranean water is usually a line having a considerable declivity.

The very fact of water standing at such a declivity is clear evidence of movement, and the observed declivity is called the angle of friction, or the measurement of the resistance of the water in moving through the strata, just the same as the fall in the surface of an open stream is the measurement of the resistance the water meets with in its passage down the channel of the stream. It was pointed out by Professor Prestwich, some years ago, that subterranean water is governed in its movement by the same laws as regulate surface streams. The more the question of movement of subterranean water is investigated this is found to be the case. The greatest elevation of the subterranean water is usually found under the highest lands, and the least elevation under the lands having the lowest level. The flow of water laterally is from the hills to the valleys, and longitudinally down the valley lines; therefore, as a general rule, the flow of subterranean water conforms to the surface falls of the country. There are, however, exceptions to this rule, as the author has found in several instances. An examination of a district having a number of contributing valleys shows very clearly that the subterranean water moves down the subsidiary valleys into the main valley, and the confluence of the streams produces identically the same effect in the underground channels as is observed by the junction of two streams, or the water flowing in two pipes. The increase of the volume of water brought into a main subterranean channel from a subsidiary valley elevates the surface of the water at the point of junction. This is clearly indicated by the longitudinal section of a main valley joined by contributory valleys at various points. Taking any one of these examples, it is found that if a line is drawn from the surface of the water, at a point above where a junction is known to take place with the surface of the water at another point below where the junction is effected, the result shows that at every period of the year, and whether the water is rising or falling, there is a considerable convexity in the longitudinal section of the water at the point at which water is received. A number of examples of this character are shown in making careful sections of the chalk valleys south of Croydon, particularly in a valley about eight miles long, extending from Caterham to the river Wandle at Croydon. Not unfrequently we find one valley runs across another, and such continuity of the surface may be observed which might lead to the supposition that the flow of subterranean water is continuous down the valleys. This, however, is not always the case, as is clearly shown by a section made above Croydon, in the neighbourhood of Smitham Bottom, in the valley line between Merstham and Croydon. It might be supposed that the water flows from Merstham to Croydon, but this is not so, for the cross valley at Smitham Bottom intercepts the water, and conveys it away in another direction. This abstraction of the water is clearly indicated by the depression in the water-line at the point where the water leaves. A line drawn from a point in the water-line above the point of abstraction, to a point in the water-line below this point shows, during all periods, a concavity in the water surface at the point of abstraction. Where such a depression is observed it is evidence of the abstraction of water. Just the same is observed by pumping from a well; the water is generally lowered all round the point of abstraction. The amplitude of the depression is greatest near the point of abstraction, and diminishes as we leave this point. It thus becomes quite feasible to determine, by careful survey, the exact direction in which subterranean water is flowing in such a district as that which has recently been under the examination of the author, and also to pretty accurately determine both the extent of the contributing area and the probable quantity of water such an area will yield. A point of interest in reference to the rise of the water in the chalk is that, taking a long valley, as, for example, the Caterham Valley, observation clearly shows that the water begins to rise in the wells located at the top of the valley before it rises in the wells situated in the lower parts of the same valley—in fact, the water in the upper wells began to rise while the water in some of the lower wells was still falling. Here, again, there is a parallelism of what is observed with regard to surface streams—that the floods descend from the higher to the lower parts of the country. It appears singular that the wells in the upper part of the basin should begin to rise first, and the only solution that the author can offer for this circumstance is that the rainfall is greater upon the higher lands than in the lower parts of the valley, for it is quite clear that on Nov. 25, 1876, the water in the well began to rise at Cambrian House, in the upper part of the Caterham Valley, but it was not until after the 3rd of December that the water in the wells began to rise in the lower parts of the valley at Croydon, and the water in an intermediate well at the Rose and Crown Inn, Riddlesdown, did not rise until about the 12th of December. In this case the water rose both in the upper and lower parts of the same valley before it rose at an intermediate point. The rise in the upper part of the valley was probably due to rainfall, and the rise in the lower part was probably due to the effect of the united contributions of a number of short valleys discharging into the main valley. Another point which is deserving of attention has reference to the temperature of the water. Well water is usually much colder, and of much more uniform temperature, than ordinary surface water. Its coldness is, in part, no doubt, due to the fact that the greatest absorption of rain takes place in the winter months, and the water enters the ground at a cold period, and at about the normal temperature of the air. Very careful observations, on the chalk formation south of Croydon, show that the month of December is the month which appears principally to contribute to the supply of the springs, and that after a rainfall it takes some time for the springs to rise, depending mostly on the dryness or wetness of the season. A small rainfall in December is almost sure to be followed by low springs in the following year, or a dry December interferes to a marked extent with the contribution of water to the springs; for, although experiments with percolation gauges show that certain quantities of water percolate at all periods of the year, the measurement of wells, and gauging the volumes of springs, show that a large part of the rain falling never influences the quantity of water in the ground in the slightest degree. In the year 1876, between the beginning of May and the end of November, although over 12 inches of rain had fallen at Croydon, the rainfall did not affect the quantity of water in the subsoil, but during the whole of this period both the volume of water flowing from the springs and the height of the water in the subsoil steadily diminished. During the present year there has been a gradual subsidence in the water, both with regard to its altitude and volume, since the 25th of April, although between the beginning of April and the end of July upwards of 10 inches of rain had fallen. It is found, upon examination, that the water of the deep wells in the higher parts of the district, notwithstanding the greater depth of the wells, has a lower temperature than the water in the wells, in the lower portion of the district, that are not so deep. The water of wells which have been sunk into the upper greensand has relatively a lower temperature than the water of wells sunk in the chalk. At certain periods, the temperature of the water at the surface of the well is somewhat warmer than at the bottom of the well. In other cases the water at the bottom of the well is equal in temperature, or exceeds that of the surface. In all probability, in the cases where the surface temperature is greater than the bottom temperature, it is due to the conduction of heat from the warmer air of the well to the surface of the water, and the heat being transmitted through the water very slowly downwards tends to keep the water at the surface at a higher temperature than at the bottom of the well. This is very clearly shown in the case of the temperature of the well at the water-works at Croydon. The upper water in the well on Dec. 6, 1876, had a temperature of 64·5°, while at the bottom of the well the temperature was 51·25°. The increase of the surface temperature in this case was due to the admittance of hot water from the surface condenser into the well. The temperature observed at the bottom of the well was about the ordinary normal temperature. In cases in which the water is excessively cold at the bottom of the well, it is probably due to the inferior motion of the water, the strata being dense, and there being less circulation. In the lower districts, especially where the water rises into the gravel and has very free movement, the temperature of the water is higher than in the chalk. The temperature of the water under the town of Croydon, which is built upon the outflow of the springs into the gravel, is higher than in the wells immediately outside the town. The movement of the water from the higher to the lower districts would, of itself, tend to raise the temperature. The descent of the water from a high to a low elevation would also tend to compress air and gases held in the interstices of the water, and thus would tend to increase the specific heat. Probably to these two circumstances may be attributed the slight increase in the temperature of the water observed in moving down such valleys as that of Caterham, which has its discharge into the River Wandle, at Croydon, and also in other valleys in this neighbourhood.

Appended to the paper was a schedule of well-gaugings in the valley from Caterham to the River Wandle, at Croydon.

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

With the now rapidly approaching close of the year there has come a slighly increased amount of activity in the local iron trade, but it is distinctly understood that in most of the departments this alteration is purely owing to the "season" spurt, and is not to be taken as any criterion of what may be the state of things when work is commenced in the new year. For pig iron there is only a modest inquiry in the open market, and the current sales are anything but large. There are a good many furnaces in blast, however, here and there; but these are chiefly located in connection with large foundries, or finished iron-works where most of the pig smelted is made use of on the spot. This is the case at Thorncliffe, where two furnaces are going, at Sheepbridge where there are four or five, out of a total of about nine, at work, and at Parkgate, where only two out of six are in blast. A similar proportion is being run at the other large Derbyshire and South Yorkshire concerns, such as Renishaw, Staveley, Derby, Butterley, Ardsley, Milton, &c. In North Lincolnshire nearly three-fourths of the whole number of furnaces built are out, and are likely to remain so, whilst a considerable reduction of the present heavy stocks has been effected. These circumstances seem to lead to the general conclusion that for the next three months, at all events, we are safe from any great rise in the price of iron, whether pig or finished, so that pipes and such other castings as are needed by gas and water companies are certain to be on offer at the present or even, it may be, at still lower rates. The only event which could produce an opposite effect would be the sudden termination of the war, and that, unfortunately, is a contingency which can hardly be looked for within so very brief a period.

In the coal market there is a great surplus of supply over demand in almost every branch, not even excepting house coal, which is generally sought after somewhat keenly just prior to Christmas. Almost all the coalowners and merchants report a fair amount of business in house coal, but they have not the slightest difficulty in supplying the wants of their customers. For steam coal, the shipping season has now terminated, one result of which is that, at many of the collieries, large quantities of this kind of fuel are now being stacked on the pit banks. For gas coal there is not much inquiry in the open market, but there are, as a matter of course, steady deliveries on contracts for London and the chief towns of the Midlands, Lancashire, and the east coast towns. Prices range from 7s. to 9s. 6d. per ton, put into railway trucks by the consignors. Ordinary coke and gas coke are plentiful at nominal prices.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

There is still but a poor demand for any class of fuel in this market. Stocks, especially of the inferior sorts of fuel, are going down in many quarters, and prices continue low. The better classes of round coal move off only slowly, owing to the continued openness of the weather; and both round coal, burgy, and slack, for iron-making and general manufacturing purposes, are extremely difficult to sell, many of the works being closed for stock-taking, whilst those that are going are in most cases only partially employed. There is a good deal of pushing for orders in the inferior classes of fuel; and some underselling where needy holders have large stocks; but the general market quotations are without material change, as they are already quite as low as can be accepted if legitimate business is to be done. Best Arley coal, for house fire purposes, is quoted at the pit mouth at 10s. to 11s. per ton; common ditto, 8s. to 9s.; Pemberton four-feet, 8s. to 8s. 6d.; common round coal, 6s. 6d. to 7s.; forge coal, 5s. 6d. to 6s. 6d.; burgy, 4s. 6d. to 5s. 6d.; good ordinary slack, 3s. 6d. to 4s.; and common ditto, 2s. 6d. to 3s. per ton.

I understand that the South Lancashire and Cheshire Coalowners Association, in conjunction with the other colliery proprietors throughout the kingdom, have resolved to secure, if possible, such modifications in the Home Secretary's Bill with reference to the use of gunpowder as that the proposed restrictions shall not apply to the firing of shots in the mines during the night time.

The National Association of Certificated Colliery Managers have now commenced a series of meetings in the various mining districts in England for the purpose of making known the objects of the newly formed organization, and the first of these was held last week at Wigan, when a deputation was appointed to attend a general meeting which is shortly to be held in Birmingham.

The iron trade of this district continues in a very depressed condition, and although the local producers of pig iron are still securing sufficient

orders to take off their present limited production at late rates, finished iron makers, founders, and engineers all complain loudly of the extreme scarcity of new business, and the exceedingly low figures at which it has to be taken where it is secured. Bars continue weak in price, North Staffordshire makes delivered into the Manchester district being now offered at £6 10s., and Lancashire and Middlesbrough bars at £6 5s. to £6 7s. 6d. per ton, with other descriptions of finished iron in proportion.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The steam coal trade of the North of England is in a very disturbed state. The Northumberland masters have intimated to the men a reduction of 12½ per cent. on present wages, and decline arbitration. The men are holding meetings with a view to see some middle course that may be taken. If not, they will have to submit to the full reduction or be locked out. The steam coal trade is very depressed. The north country coal-owners state that they are subject to great competition from the South Wales and Scotch collieries, whose men are working for lower wages than those in Northumberland, and that, if they cannot get the reduction, they must close the pits. All the colliery owners are not agreed, however, to a lock-out, and if it should be adopted, a dozen or more pits will be kept working. The best gas coal trade is kept going pretty briskly. The shipments from the Tyne Dock are quite an average, and at the end of the year it will be found that more gas coals have been sent from the Durham collieries through steamers and sailing vessels in 1877 than in 1876. No doubt, however, a falling off will be shown in the quantity of coal sent by railway, as the cost of carrying by shipping has been much lower than the ordinary fixed mileage of railways over the whole of the year. Second-class gas coals, as reported last week, are only in very moderate demand, with a considerable variation of prices. House coals have had an ordinary December sale, without any alteration in prices. It will be seen in a few days what course the Northumberland miners will take. If they submit to the reduction, lower prices may prevail for coals after Christmas. If they are locked out there will be an extra demand upon Durham coals, and no doubt the price of second-class gas coals would then stiffen, as they could make a very fair second-class steam upon a pinch.

The wind having got from the north, very heavy sailing of coal-laden vessels took place from the Tyne on Friday, and a considerable fleet of small vessels laden with gas coals are upon their passage to the south of England. Rates for steamers to load coals to London are from 4s. 6d. to 4s. 9d. per ton, with other coasting ports in proportion. Business to the Mediterranean is quieter, and little is doing to France. The Cleveland iron trade is very little altered. The prospects are not encouraging. The only hope that ironmasters have is peace in the East, and that there will be a revival of business in the spring of the year. Until then very little is expected to be done.

The general manufacturing trades of the Tyne are absolutely unaltered. Manufacturers are doing as little as possible, and are hoping for better times with the turn of the year. Business at present is unprofitable in almost every branch. The chemical market is no better.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

At present there is only one town in Scotland where the price of gas is selling at the remarkably low price of 3s. 9d. per 1000 cubic feet—namely, Galashiels, which is much farther away from the source of supply of cannel coal than many places where a much higher price is charged. Till within the last two or three months, the same price was charged at Coatbridge, but it is now raised to 4s. 2d. per 1000 cubic feet, chiefly on account of the large capital required in connection with the new works. Even yet many persons are of opinion that the gas in that town is still at the low price at which it was formerly sold. A movement has now arisen in the Town Council of Hamilton to have the price of the gas supplied to the town reduced to the same low rate, while one of the members of that body is even of opinion that it might be made and sold at a profit at 3s. 4d. per 1000 feet. In the meantime, on the suggestion of the Provost, the matter has been remitted to the Gas Committee, who will consider the question, and report upon it as soon as possible. Mr. Tainsh, the late convener of the Gas Committee, said, in the course of the discussion, that it had been their intention six months ago to recommend to the council to reduce the price to 3s. 9d., and he thought they would be perfectly safe in doing that now.

At the ordinary monthly meeting of the Town Council of Ayr, on the 10th inst., the Lighting Committee reported that they had, at great length, considered the town's accounts with the gas company. Prior to 1875 the company had allowed the town a discount of 30 per cent. on their accounts, in virtue of certain privileges conferred upon them in the matter of opening up the streets, &c.; but in that year the company had resolved to put the town in the same position as individual consumers. The directors now proposed to allow the corporation 5 per cent. discount in respect of their being such large consumers; their burners should supply gas equal to 24 sperm candles; and that the pressure of the gas should not be less than the company would be bound to maintain under the Police Act; but they declined to bind themselves to pay only 6 per cent. to the shareholders, while they were empowered to pay 7½ per cent. While they would endeavour to reduce the price of gas, they must, at the same time, remember the interests of their shareholders. After some discussion on the report, it was remitted to the Lighting Committee, to endeavour to have an arrangement concluded on the old terms, such as had lasted for fifteen years.

I understand that Mr. James Hislop, manager to the Partick, Maryhill, and Hillhead Gas Company, has been commissioned to design new gas-works for Dullatur, a village some eight or ten miles distant from Glasgow, on the Edinburgh and Glasgow Railway, which is fast rising into importance as a residential suburb for Glasgow merchants and other well-to-do people. Having mentioned Mr. Hislop, I may incidentally remark that there is at present an arbitration case in progress in which he is intimately involved. It may be remembered that fully two years ago an opposition gas supply undertaking was started for Uddingston and Bothwell, and adjoining districts, and that gentleman was employed to design the necessary works. Eventually, however, the scheme fell through, the shares of the proposed company not having been taken up, and the original promoters of the scheme could not be got to "cash up" for the professional work done at their instigation by Mr. Hislop. It is this matter which is now under arbitration, the sole arbiter being Mr. George Bell, civil engineer and architect, whose services are in great request in extra-judicial inquiries of a more or less similar character.

During the week ending Dec. 8, the gas supplied to the city of Glasgow was, in one instance, found to have an illuminating power equal to 28·59 candles, but in another case the illuminating power was down at 25·08, or only a very small fraction over the parliamentary minimum.

An abstract of the income and expenditure on account of the water-works which were completed about a year ago for Dalry, in Ayrshire, has just been made public. It shows that the cost of the works was rather in excess of £10,000. The water-rate for the ensuing year has been fixed at 1s. per £1 on gross rental, payable one-half by the proprietor and one-half by the tenant.

The estimated cost of the water scheme for Kirkwall was at first £10,170, but the engineers, Messrs. Leslie, Edinburgh, have now in view the construction of a reservoir, which is calculated to cost £4000 additional. Besides this there is a further sum of £1000, comprising extras, engineers and inspectors charges, &c.

It has been resolved by the Perth Water Commissioners to borrow money for the execution of the new water-works from Messrs. H. Salter and Sons, London, commencing with the sum of £23,500, at 4½ per cent., payable in 30 years.

Considerable progress has recently been made with the new water-works for Dunfermline. Messrs. Laidlaw and Maclaren had supplied 2680 tons of pipes, or about 96 per cent. of the whole contract, up to the 5th of December, and at the same time 21,362 yards, or 91 per cent. of the whole length, had been laid.

The rainfall at Dumfries for the month of November was 8·44 inches, while during the 11 months, January to November, the total rainfall was 52·00 inches, as against 35·54 inches in the corresponding period of 1876. Last month's rainfall at Aberfeldy was 6·91 inches. At Portree, in Skye, the rainfall during October was 13·36 inches. Between Sunday, the 14th, at 9·30 a.m., and Monday, the 15th, at the same hour, the registered rainfall was 5·57 inches. On 27 days during November, 11·26 inches of rain fell.

It is expected that the water and drainage works required for the Carluke district of the upper ward of Lanarkshire will cost £5600 and £2000 respectively.

A drainage scheme, designed by Mr. Young, C.E., Perth, which is estimated to cost £3800, has been resolved upon by the Police Commissioners of Blairgowrie.

Dr. Stevenson Macadam, as one of the Police Commissioners for Portobello, has prevailed upon his fellow-commissioners to institute an important experiment with regard to the ventilation of the common sewers of the town.

Last week's pig iron warrant market was very steady, the fluctuations being small. Business was done on Friday afternoon at 52s. 3d. seventeen days, and 52s. 3½d. one month, the week closing with the price about 1d. per ton under the closing price on the previous Friday.

The local coal market is still very slack and inactive, but house coal is rather improving in demand.

In the "Trade Notes," on the 4th inst., it was stated that the price of gas at Coatbridge was 3s. 9d. per 1000. This was a mistake, the directors having only reduced the price to 4s. 2d. since the beginning of October last.

BIRMINGHAM WATER SUPPLY.—Dr. Hill reports that the water supply to Birmingham during November was clear, but that the proportion of organic impurity had increased, owing probably to the recent rains.

GLASGOW WATER SUPPLY.—The Glasgow water, derived last month from Loch Katrine, is reported by Dr. Mills to have contained a few muddy particles and fibres; it also showed an unusually high proportion of organic carbon and nitrogen.

CRAWLEY GAS COMPANY.—The directors report, submitted to the shareholders at their meeting on Thursday last, shows that they have a balance available for dividend of £203 7s., out of which they recommend a dividend for the year ending at Michaelmas of 6 per cent., free of income-tax. The whole plant of the company is in excellent condition and repair.

TRANSFER OF THE RETFORD GAS-WORKS TO THE CORPORATION.—At the meeting of the Retford Town Council, on the 10th inst., the seal of the corporation was affixed to an agreement for the purchase of the undertaking of the Retford Gas and Coke Company, and some terms of congratulation were expressed on this important scheme having been brought so near completion.

BOLTON PUBLIC LIGHTING.—The Gas Committee of the Bolton Corporation, at their meetinglon the 4th inst., resolved that, "having in view the proposed increase in the rates of the borough, this committee directs the lighting inspector, until further orders, to exercise a discretion in the lighting of the public lamps on moonlight nights during the winter months of the year, in the same manner as during other months."

SALES OF GAS AND WATER SHARES.—On Monday, the 10th inst., 81 fully paid-up £10 shares in the Bromley Consumers Gas Company were sold by auction at Bromley, and averaged over £23 each; 32 new £10 shares, on which £2 had been paid, averaged about £7 5s.; and 175 fully paid-up £10 shares averaged over £22 each. At the Auction Mart, London, on Wednesday last, one-fifth of a King's freehold share in the New River Company was sold at the rate of £96,200 per share, and 18 New £100 Shares (paid up) were disposed of at the average rate of £310 11s. each.

REDUCTIONS IN THE PRICE OF GAS.—The Knaresborough Improvement Commissioners will reduce the price of gas in their district, at the beginning of 1878, from 4s. 2d. to 3s. 4d. per 1000 cubic feet. The Rossendale Union Gas Company have intimated their intention to reduce the price 3d. per 1000 from Jan. 1, 1878. The Lowestoft Gas Company have reduced the price of gas to private consumers to 4s. 9d. per 1000, and they have intimated to the Improvement Commissioners that, notwithstanding the fact that the contract for the public lamps is based on the charge of 5s., they will, after Christmas, make a corresponding reduction in the price to the commissioners. At the meeting of the Cromer Gas Company, on the 30th ult., it was stated that from the 6th of January next a reduction to 5s. 10d. will take place.

UPPER SEDGLEY GAS SUPPLY.—At the meeting of the Sedgley Local Board, on the 11th inst., a letter was read from the secretary of the district gas company, stating that the directors would be quite willing to sell the Lower Gornal works. The works cost about £3400, when building materials and labour were cheaper, and the sale would have to be made subject to the existing lease, but it was believed there would not be any serious difficulty with the lessee in getting him to surrender it. The company suggested for the board to make an offer, or they would confer with a deputation. The members were generally of opinion that the purchase would be advantageous, and that the undertaking to supply the district would prove very beneficial. It was said that under the management of the board the consumption would be increased, and the mains be very much extended. It was resolved to take steps to borrow £5000 in anticipation of the purchase.

MONTE VIDEO GAS COMPANY, LIMITED.—The directors have issued a circular to the shareholders in which they remind them that at the ordinary general meeting, held on the 28th of May last, it was stated that, although the company had earned profits abundantly sufficient for a final dividend for the latter half of the year 1876 (the profit and loss account showing a balance of £22,184 4s. 1d. after providing for the interim dividend) so large an arrear remained owing by the Government that the board had not then sufficient funds in hand to pay it. The directors state that sufficient funds have now been remitted from Monte Video, and they therefore convene an extraordinary general meeting of

shareholders at the company's offices, on Thursday next, at which a resolution will be proposed declaring a dividend on the shares of the company for the half year ending the 31st of December, 1876, at the rate of 16s. per share, free of income-tax, being equal to 4 per cent. on the capital paid up, which, with the interim dividend previously paid, makes 8 per cent. for the year. The meeting will be of a purely formal character, as no other business will be transacted than passing the above resolution.

Society of Engineers.—At the twenty-third annual general meeting of the Society of Engineers, held on Monday, the 10th inst.—Mr. Thomas Cargill, president, in the chair—the following gentlemen were balloted for, and duly elected as the council and officers of the society for the year 1878—viz., as president, Mr. R. P. Spice; as vice-presidents, Mr. C. Barnard, Mr. J. Bernays, and Mr. T. Porter; as other members of council, Mr. J. Church, Mr. F. E. Duckham, Mr. F. W. Hartley, Mr. C. Horsley, Mr. A. Rigg, Mr. J. Walker, Mr. S. Cutler, and Mr. L. Perkins; as honorary secretary and treasurer, Mr. Alfred Williams; and as auditor, Mr. W. H. Bennett. It was announced by the president that the following premiums had been awarded by the council, for papers read during the year—viz., to Mr. J. W. Pearse for his paper on "The Mechanical Firing of Steam Boilers;" to Mr. Alfred Le Grand, for his paper on "Tube-Wells;" and to Mr. Ralph H. Tweddell, for his paper on "Direct-acting Hydraulic Machinery." Votes of thanks were unanimously accorded to the president and council for 1877; to the honorary secretary and treasurer, Mr. Alfred Williams; to the acting secretary, Mr. Perry F. Nursey; and to Mr. T. H. Martin and Mr. W. S. Wilkins for acting as scrutineers of the balloting lists.

Local Government Board Inquiry at Croydon.—On the 11th inst., Lieut.-Col. Cox held an inquiry at Croydon, upon an application by the Rural Sanitary Authority, for authority to borrow about £80,000 of the Public Works Loan Commissioners, for the purpose of providing a system of drainage for the parishes of Mitcham, Merton, Morden, Wallingdon, and Beddington. The district proposed to be drained is 15 square miles, the drainage having, up to the present, been met by cesspools and brick sewers in some places. The present scheme is prepared by Mr. Baldwin Latham, C.E., and it is proposed to dispose of the sewage of the district by means of the intermittent filtration system, land sufficient for the purpose having been secured within the district of the Wimbledon Local Board. The greater part of the district will drain by gravitation towards this point, a small portion only having to be pumped; in fact, the site selected is the natural spot to which the drainage of the district would flow. It is proposed to send the purified water into the Wandle, a short distance from the filter-beds, the bottom of which will be on a level with the Wandle at this point. The ground selected is adjacent to the sewage farm of the Wimbledon Board, the cemetery of Wimbledon, and that of Lambeth, and the Mitcham Gas-Works. This is the third scheme submitted for the drainage of this district.

Gas Explosions in Scotland.—On Wednesday last a serious and fatal explosion occurred at the old gas-works, Newton Stewart. As the station-meter had been slightly out of repair, Mr. Bassett, the manager, obtained the assistance of a blacksmith, in order to put it in order. The latter, during the temporary absence of the manager, incautiously proceeded with a lighted candle to enable him the better to do the work, when an explosion instantly took place, knocking out both ends of the meter, and scattering the broken fragments of the metal in all directions. Several of the pieces entered the man's skull, which was literally battered in, and he was otherwise severely lacerated about the body. He died in about fifteen minutes after the explosion. Mr. Bassett, who was entering the meter-house at the time, was also struck by the broken metal, and bruised on the legs, &c.—Another explosion of gas took place on Friday at Long Close, Kirkwall, severely burning in the face Mr. J. Malcolmson, one of the contractors for the new drainage works. Mr. Malcolmson had suspected the presence of gas where the men were at work, and, striking a match, applied the light to the gas-pipes without effect. He then threw the match into the drain, and an explosion instantaneously ensued.—Early on Friday morning an explosion of gas also took place in the recently-opened New Public Halls, Glasgow. A large portion of the lath and plaster was displaced, and the man who was the immediate cause of the explosion received some injuries, but otherwise no serious damage was done.—On Wednesday evening there was a serious explosion at Strathaven, near Hamilton, a large quantity of gas having caught fire somehow in a back apartment attached to a grocer's shop, in which the stopcock of the gas-bracket had not been properly turned off.

Great Grimsby Gas-Works.—The new works which have been in the course of erection and construction during the past two years at Sheepfold Street, are now so far completed that they have been brought into operation, and the whole of the gas supplied to the public is manufactured there. Some details yet require carrying out which do not interfere with the working, but when completed will add to the general efficiency of the works and apparatus. The buildings consist of retort-house, 217 feet long by 104 feet wide, and 24 feet high to wall-plate. The roof, which is iron, consists of three bays, the middle one over retort-bench having a span of 45 feet, the outer spans each about 28 feet. The chimney, which stands in the middle of the retort-house, is 122 feet high from ground line, 10 feet square at base outside, and 5 feet square inside, parallel without break or offset. Purifying-house, meter and governor house, 130 feet long by 40 feet wide. Exhauster-house, 39 feet by 30 feet, with boiler-shed adjoining. The apparatus consists of retort-bench of 100 mouthpieces; condenser of four upright annular pipes, 30 feet high, 3 feet 4 inches external diameter, and 3 feet internal diameter, connected with two 12-inch diagonal pipes to each pair of annulars; two pairs of exhausters on separate bed-plates, each pair capable of passing the whole of the gas that can be made with the present number of mouthpieces; washer or scrubber, 45 feet high by 10 feet internal diameter, with machinery room on the top, containing water-cistern and distributor, worked by a small engine fixed in exhauster-house. The purifiers consist of four cast-iron boxes with wrought-iron covers, each box 22 feet 6 inches by 18 feet, by 4 feet 6 inches deep, fixed in a line, with travelling apparatus overhead for lifting the covers. Station-meter to pass 30,000 cubic feet per hour, and a governor for supplying the town through a 16-inch main now being laid. The floors of the purifying and meter houses are raised, so that the valves and connections can be examined when necessary. The tanks for receiving the tar and ammoniacal liquor will hold about 45,000 gallons. A siding has been laid from the Great Northern Railway Company's yard into the works, and a weigh-bridge put down for weighing all material into and out of the works; also lines of rails laid into the retort-house, from which coal can be deposited in front of the retorts, and coke, which is stored betwixt the rails and outer walls, can be loaded into trucks direct. A gasholder-tank, 152 feet diameter and 26 feet deep, is now being built, and the holder will be single-lift, to contain about 450,000 cubic feet of gas; and, having in view the future requirements of the town, the retort-house is capable of holding 140 additional mouthpieces, the leading mains, connections, and exhausters being sufficient for such extensions, and foundations are ready for additional scrubber and station-meter when required. The whole of the buildings and arrangement of apparatus have been erected and fixed from designs and plans prepared by Mr. James Jowett, the company's engineer and manager. The total cost of the works, including some contemplated extensions of mains, will be about £30,000, and it is estimated that at present they are capable of producing 100 million cubic feet of gas per year, as against 70 million cubic feet at the old works. In concluding this short sketch, it is necessary to state that much labour will have to be bestowed upon the yard and its surroundings before the works will have a presentable appearance. We are pleased to hear that the directors of the gas company have shown their appreciation of the extra services of their manager—Mr. Jowett—in connection with the extensions, by presenting him with a cheque for £100.—*Grimsby News.*

Register of New Patents.

APPLICATIONS FOR LETTERS PATENT.

4637.—Bond, F. T., Gloucester, "Improvements in filters." Dec. 7, 1877.
4643.—Davies, W., Liverpool, "Improvements in regulating, controlling, or measuring the supply of liquids for water-closets and for other purposes, and in apparatus therefor." Dec. 7, 1877.
4666.—Proud, T., Birmingham, "Improvements in apparatus used in the purification of gas." Dec. 8, 1877.
4667.—Proud, T., Birmingham, "Improvements in flexible valves for preventing the escape of gas when laying, repairing, or connecting gas-mains." Dec. 8, 1877.
4668.—Dangerfield, J., Birmingham, "An improved self-closing tap." Dec. 8, 1877.
4688.—Nawrocki, G. W. von, Berlin, Germany, "Improvements in pumps." A communication. Dec. 10, 1877.
4700.—Barlow, A., Tonge, and Iden, W., Chadderton, Lancs, "An improved universal joint for water-pipes, used for extinguishing fires and for other purposes." Dec. 11, 1877.
4703.—Rommel, A., Moorgate Street Buildings, London, "Improvements in oscillating pumps." A communication. Dec. 11, 1877.
4722.—Sweet, A., Hampstead Road, London, "Mechanical improvements in the sanitary flushing of water-closets, with a fixed or uniform quantity of water at each flush, divisible into two parts, flush and after-flush." (Complete specification.) Dec. 12, 1877.
4724.—Brown, B. L., Wednesbury, Stafford, "An improvement or improvements in connecting and disconnecting pipes or tubes." Dec. 12, 1877.
4725.—Staples, H., Belsize Park, and Wilson, T. S., Crouch Hill, London, "Improvements in filter-presses." Dec. 12, 1877.
4743.—Hodgkin, J. E., and Neuhaus, M., Queen Victoria Street, London, "Improvements in valves and valve-seats, applicable to what are commonly known as pulsometers, also to pumps and other like apparatus." A communication. Dec. 13, 1877.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

2362.—Wallace, R. W., Battersea Park, and Claus, C. F., Great St. Helen's, London, "Improvements in the purification of gas, and the utilization of bye-products by the manufacture of secondary products therefrom." June 16, 1877.
2373.—Nawrocki, G. W. von, Berlin, Germany, "Improvements in furnaces for the manufacture of illuminating gas, partly applicable to furnaces for heating purposes generally." A communication. June 19, 1877.
2596.—Mewburn, J. C., Fleet Street, London, "Improvements in apparatus for indicating, registering, and regulating the speed of engines and rotating shafts for measuring the flow of water or gas, and for other purposes." A communication. July 5, 1877.
3643.—Fryer, A., Wilmslow, Chester, "Improvements in the method of and apparatus for treating the refuse of towns." Sept. 29, 1877.
3839.—Jablochkoff, P., Paris, "A new system of distributing and increasing with atmospheric electricity currents proceeding from a single source of electricity for the purpose of supplying several lighting centres." Oct. 17, 1877.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

3997.—Robinson, J., "Improvements in apparatus for charging gas-retorts." Nov. 21, 1874.
4027.—Harrold, W., "Improvements in gas-stoves." Nov. 24, 1874.
4035.—Mills, B. J. B., "Improvements in rotary motors and pumps." Nov. 24, 1874.
4153.—Hunt, B., "Improvements in the means of and apparatus for clarifying cane-juice, the same being also applicable to the production of bisulphate of lime or other combination of sulphurous gas, or carbonic acid gas, or other gas with an alkali." Dec. 3, 1874.
4158.—Goodall, R., "Improved means or method of clarifying impure water or sewage, and preparing the precipitate or sludge for re-use." Dec. 3, 1874.
4189.—Willans, P. W., "Improvements in hydraulic engines and pumps." Dec. 5, 1874.

NOTICE OF REMOVAL.

D. BRUCE PEEBLES & CO.

Beg to announce that they have REMOVED to their New Premises,

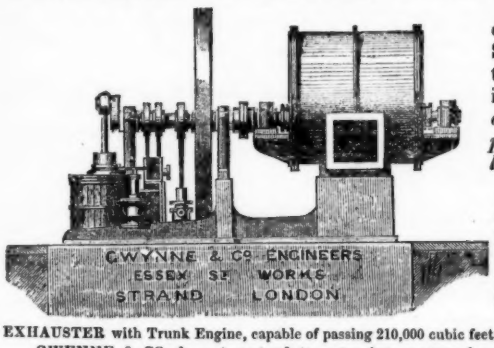
TAY WORKS, BONNINGTON, EDINBURGH,

To which all communications should now be addressed.

May 30, 1877.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, and TWO MEDALS at the PHILADELPHIA EXHIBITION have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS;
Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

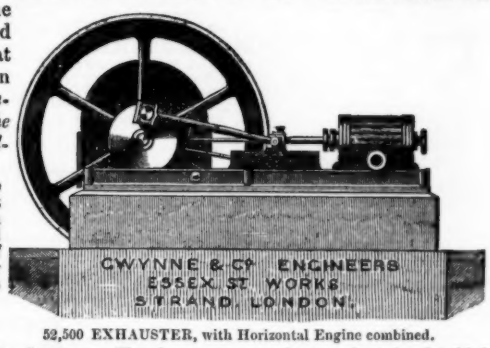
GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"*Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship.*"

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 7,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



52,500 EXHAUSTER, with Horizontal Engine combined.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, *but to produce machinery of the very highest quality, and most approved design and workmanship.* The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas without oscillation or variation in pressure.
Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, **GWYNNE & CO.**, Hydraulic and Gas Engineers,
ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

☞ *G. & Co. are now making 6 Sets Exhausters and Engines for 105,000 cubic feet per hour, 3 Sets 180,000 Exhausters and Engines, with many others of all Sizes.*

Now ready, price One Shilling, No. 13 (to be continued Monthly) of

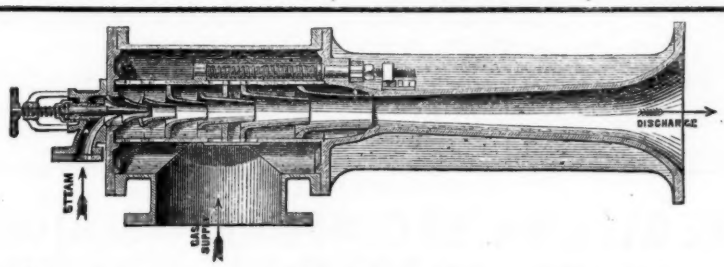
A TREATISE ON THE SCIENCE & PRACTICE
OF THE
Manufacture and Distribution
OF
COAL GAS.

LONDON: WILLIAM B. KING, 11, BOLT COURT, FLEET STREET,
OR OF ANY BOOKSELLER IN TOWN OR COUNTRY.

For the convenience of persons resident in remote districts, arrangements have been made by the Publisher to forward the "Treatise" by Post, securely packed, at the cost of 1s. 2d. Monthly, or 7s. for the Half Year.

PATENT HYDRAULIC LIFTS, CRANES, HOISTS,
Suitable for Lifting Purifier-Covers, &c.

S. CLAYTON & CO., BRADFORD, YORKS.



KÖRTING'S STEAM-JET GAS-EXHAUSTER.
IMPROVED CLELAND'S PATENT.
UPWARDS OF 250 IN USE.

CLELAND'S PATENT CONDENSER AND STEAM SCRUBBER.

FOR PARTICULARS, APPLY TO

KÖRTING BROS.,
17, LANCASTER AVENUE, MANCHESTER,
OR TO
GERALD J. TUPP, 8, John Street, Adelphi, W.C.,
LONDON,
SOLE AGENT FOR ENGLAND AND WALES.

WANTED, immediately, a good Fitter, used to outside service and main work. Good wages for an experienced, steady man.
Apply, by letter only, to No. 426, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by the Advertiser, one or more parties to join him in Purchasing and Working Gas-Works, where there is a sure return of 10 per cent. profit on the amount of capital invested.
Apply, by letter only, in first instance, to No. 424, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, the Address of Gas Com- panies who have not received a Copy of the New Edition of PAMPHLET for GAS COMPANIES to distribute to their Gas Consumers—"Cooking and Heating by Gas."
Price £1 per 100, £6 per 1000. Copies by post Threepence—direct from the Author, MAGNUS OHREN, Gas-Works, SYDENHAM, S.E.

WANTED, Orders for Samples to test the superior Silkstone, Wigan, and other Gas Coals and Cannel on Sale by G. J. EVERSON, Gas Coal and Cannel Contractor, BIRMINGHAM.
N.B.—Prices on personal application, or by post or telegram, on shortest notice, and prompt delivery.

WANTED, by a Young Man, the son of a Gas Engineer, a situation as ASSISTANT in a large Gas-Work, or as Manager of a smaller one. Is a good draughtsman, has a knowledge of chemistry, and is quite competent to take charge of a work. Can be well recommended.
Address No. 415, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by Samuel Thompson & Co., Colliery Office, Lancaster, APPLICATION for PRICES from Gas Managers who are prepared to receive Tenders for GAS COAL or CANNEL.
John Leigh, Esq., M.R.C.S., F.C.S., &c., &c., in his analytical report of S. T. & Co.'s Coal, says: "It is remarkable for its purity, I have scarcely ever examined a Coal containing so small a quantity of ash, and when Cannel of the best description is scarce, it may well replace this material."

AN experienced Gas Purifying Wood Sieve MAKER wants a JOB in a Gas-Works.
Address W. K., 12, Brill Terrace, PANCRAS ROAD, N.W.

GAS Manager wanted for small Works on the Mediterranean. Married man preferable. Must know French. House, &c., on the premises. Must be able to take sole charge. Salary £120 to £160, according to qualifications, which state in writing to GEORGE ANDERSON, 35A, Great George Street, WESTMINSTER.

TO BE SOLD, together or in Lots, Thirty SHARES of £10 each in the King's Lynn Gas Company, established by special Act of Parliament.
Apply to Messrs. HARWAR AND Co., Furnival's Inn, LONDON, E.C.

ON SALE—One Station-Meter, to pass 1000 cubic feet per hour. Almost new. Will be sold cheap.
Apply to J. HALL, Gas-Works, St. Helen's, LANCS.

GAS PLANT FOR SALE, suitable for Small Works:—
Seventeen 4-inch and 3-inch H-Pipes.
Eighteen 15-inch Circular Mouthpieces.
A 6-inch Governor.
A Station-Meter, to pass 6000 cubic feet per hour.
Scrubber and Washer combined; very good.
Vertical Condenser; very good.
Seven 7-feet lengths, 12-inch D-shaped Hydraulic Main.
Two Gasholders, each capable of holding 15,000 cubic feet.
Apply to the ENGINEER, PHŒNIX GAS COMPANY, GREENWICH.

FOR IMMEDIATE SALE, nearly new, 20-horse Double-flued Cornish BOILER, with fittings complete.
Vertical Wrought-Iron WASHER.
Six 6 in. Donkin's GAS-VALVES.
Twelve 3 in. Globular STEAM-VALVES.
Apply to C. E. BOTLEY, Gas-Works, WORMWOOD SCRUBS, W.

GAS PLANT AND 15-TON HAND CRANE FOR SALE.

THE Trustees for the District and Harbour of Maryport have FOR SALE the following ARTICLES, lately used at the old Gas-Works, which were recently purchased by the Trustees, namely—
D-shaped Hydraulic Main, 1 ft. 6 in. by 1 ft. 6 in.
Fourteen 6-in. Ascension Pipes, with arch pipes all complete.
Fourteen Mouthpieces, 23 in. by 15 in.
Four Doors and Frames.
One Set of Condensers, 36 pipes, 7-in. inlet and 7-in. outlet.
One 4800-light Meter (makers, W. & B. Cowan, Edinburgh) with 6-in. connecting bye-pass valves, gauge, clock, and tell-tale, all in good order, equal to new.
Two Governors, 6-in. inlet and 6-in. outlet, all complete.
And also a 15-ton Hand Crane complete.
Offers to be sent to the undersigned on or before the 29th of December next.
JOHN BARWISE, Clerk to the Trustees.
Harbour Office, Maryport,
Nov. 21, 1877.

TENDERS FOR SULPHATE OF AMMONIA.

THE Directors of the Cork Gas Consumers Company are prepared to receive TENDERS for all the SULPHATE of AMMONIA to be manufactured at their works during the year 1878. Delivery f.o.b. Cork. Probable quantity 100 tons. Payment net cash on delivery.
Prices to be fixed on basis of 24 per cent. Ammonia, and tenders to state whether packages are to be supplied free by sellers.
Tenders will be received up to Friday, Jan. 11, 1878.
By order,
DENNY LANE, Secretary.
Company's Offices, 72, South Mall,
Cork, Dec. 13, 1877.

NELSON LOCAL BOARD.

TO GASHOLDER MAKERS.

THE Gas Committee are prepared to receive TENDERS for making an 80-ft. Single-Lift GASHOLDER into a Double-Lift GASHOLDER.
Plans and specifications may be seen, and all particulars obtained, on application to the Manager, at his Office.
Sealed tenders, endorsed "Tender for Gasholder," must be sent to the undersigned, on or before the 27th day of December.
WILLIAM FOSTER, Manager.
Gas-Works, Nelson, Lancashire, Dec. 5, 1877.

GLASGOW CORPORATION GAS.

CHEMICAL WORKS MANAGER WANTED.

THE Gas Committee are prepared to receive APPLICATIONS for the situation of MANAGER of the Residual Product Works at Dawsholm, Maryhill.
Applicants must have a practical knowledge of the manufacture of the various products.
Sealed applications, endorsed "Chemical Manager," to be lodged with the subscriber on or before Monday, the 24th inst.
J. D. MARWICK, Town-Clerk.
City Chambers, Glasgow,
Dec. 13, 1877.

TO GASHOLDER MAKERS AND OTHERS.

THE Gas and Water Committee of the Heywood Local Board invite TENDERS for the construction and erection of a Telescope GASHOLDER, 100 ft. in diameter.
Drawings and specifications may be seen, and further particulars obtained, on application to Mr. Edwin Buckley, Engineer, Gas-Works, Heywood.
Tenders to be sent in, addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Gasholder," not later than Saturday, the 22nd inst.
The Committee do not bind themselves to accept the lowest or any tender.
JNO. BANKS, Clerk to the Local Board.
Office of Local Board, Heywood,
Dec. 11, 1877.

GAS-WORKS FOR SALE.

THE Proprietors are prepared to receive OFFERS for the Wymeswold (Leicestershire) Gas-Works. The Works consist of Retort-House, with a bench of two and a setting of one retort, Coal-Store, a comfortable Foreman's House, Meter-House, and Store-Shed, together with Retort-Fittings, Condenser, Scrubber, Two Purifiers, Meter, Governor, and Gasholder to contain about 5000 cubic feet, as well as the whole of the Mains throughout the village.
The streets are lighted up by 26 public lamps. The Works are of recent date, in very good condition, and are well situated.
The gas and meter rental amounts to over £200 per annum, and the consumers are steadily on the increase.
Further particulars to be obtained of Mr. J. B. BALL, Gas Engineer, LOUGHBOROUGH.

WILSON'S
SAFETY
AUTOMATIC PRESSURELESS DIP-PIPE,
SELF-CLEANING HYDRAULIC MAIN.

See Illustration and Description in JOURNAL OF GAS LIGHTING, *Dec. 4.*

Improved SCRUBBER, with Self-Acting Water Distributor.
Improved HYDRAULIC CENTRE-VALVE to work three or four purifiers.
Improved HYDRAULIC LIFT, by which one man can raise and remove purifier-covers of any size.
Plans and specifications prepared for New or for the Re-modelling of existing Gas-Works.
Special Designs for Gas-Works for Tropical Climates.
Particulars, &c., to be had of the Patentee, Inventor, and Manufacturer, W. P. WILSON, Consulting Engineer, 80, Cannon Street, LONDON, E.C.

LEEK IMPROVEMENT ACT, 1855.

TO GASHOLDER MAKERS.

THE Leek Improvement Commissioners invite TENDERS, with plans and specifications, for the supply and erection of a TELESCOPIC GASHOLDER, with two lifts of 30 feet each, the outer lift to be 80 feet in diameter.
Tenders to be addressed to the Chairman of the Gas Committee, Leek, and sent in before Four o'clock in the afternoon of Monday, the 7th of January next, endorsed "Tender for Gasholder."
The lowest or any tender will not necessarily be accepted.
Further information may be obtained on application to the Manager at the Gas-Works, or the undersigned.
C. HENSHAW, Clerk.
Commissioners Offices, Leek, Dec. 14, 1877.

8vo. cloth, price 2s. 6d.,

DESTRUCTIVE DISTILLATION.—A Manualette of the Paraffin, Coal Tar, Rosin, Oil, Petroleum, and Kindred Industries. By EDMUND J. MILLS, D.Sc., F.R.S., "Young" Professor of Technical Chemistry in Anderson's College, Glasgow.
J. VAN VOORST, 1, PATERNOSTER ROW, E.C.

This day is published in One Volume of more than a thousand pages, with Illustrations and Diagrams,
Demy 8vo., £1 11s. 6d.,

EXPERIMENTAL RESEARCHES in PURE, APPLIED, and PHYSICAL CHEMISTRY. By E. FRANKLAND, Ph.D., D.C.L., F.R.S., Professor of Chemistry in the Royal School of Mines, &c.
J. VAN VOORST, 1, PATERNOSTER ROW, E.C.

MICHAEL & WILL'S GAS AND WATER SUPPLY.

This day is published, second edition, 8vo., 25s., cloth,

THE LAW RELATING TO GAS AND WATER: comprising the Rights and Duties, as well of Local Authorities as of Private Companies, in regard thereto, and including all Legislation to the close of the last Session of Parliament. Second Edition. By W. H. MICHAEL and J. SHIRESS WILL, of the Middle Temple, Esqs., Barristers-at-Law.
London: BUTTERWORTHS, 7, FLEET STREET, Her Majesty's Law Publishers.

NOW READY,
THE
GAS COMPANIES
EXPENDITURE JOURNAL,

Being a Ruled Account-Book with Printed Headings, and Analyzing Guide for Keeping, upon the easiest and most correct method, the Expenditure of a Gas Company, in accordance with the provisions of the Gas-Works Clauses Act of 1871, and suitable for all Companies.
Prices, half bound, cloth sides, 2 quires, 30s.; 3 quires, 36s.; other sizes and bindings to order.
Published by EDWARD SANDELL, Accountant, 4, Skinner's Place, Size Lane, QUEEN VICTORIA STREET, and W. B. KING, Office of the JOURNAL OF GAS LIGHTING, 11, Bolt Court, FLEET STREET, E.C.

JOHN ROMANS, C.E., F.G.S.E.,
CONSULTING GAS ENGINEER
AND
CANNEL COAL FACTOR,
30, St. Andrew Square, EDINBURGH.

Plans and Estimates furnished; Gas-Works, Apparatus, Pipes, Machinery, Fire Goods, &c., supplied, or Attested and Shipped for Exportation.
GAS-WORKS TAKEN ON LEASE.

Mr. ROMANS has for upwards of 30 years been practically engaged in the Manufacture of Gas, and has, by extensive experiments, ascertained that by JUDICIOUS INTERMIXTURE of the lighter with the heavier gases, much of the rich Hydrocarbons CAN BE SAVED, which otherwise ARE LOST, during the process of manufacture. He is therefore enabled to give advice to those who favour him with their orders for Cannel, as to the class which will secure for their standard of illuminating power the HIGHEST ADVANTAGEOUS RESULTS.

ANALYSIS AND PRICES FORWARDED ON APPLICATION.

BUENOS AYRES GAS COMPANY, LIMITED.

NOTICE is hereby given to the Debenture Holders of the Buenos Ayres Gas Company, Limited, that the Half-Yearly COUPON, at the rate of 6 per cent. per annum, due Jan. 1, 1878, WILL BE PAID on and after that date, at the Company's Bankers, Messrs. Prescott and Co., Threadneedle Street, London.
Coupons must be left at the Bank three clear days for examination.
By order,
E. W. LAYTON, Secretary.
1, East India Avenue, Leadenhall Street.

T. V. CLARKE & CO., Trundley Wharf Chemical Works, Surrey Canal, DEPTFORD, S.E., are BUYERS of TAR and LIQUOR.
N.B.—Sulphate of Ammonia Plant erected for Gas Companies on a new and improved principle. Estimates given.

REMOVAL.

CHARLES HEISCH, F.C.S., Analytical and Consultimg Chemist, Superintending Gas Examiner to the Corporation of London, &c., &c., has REMOVED from 8, Savage Gardens, to 79, MARK LANE, where he may be consulted as usual.

TO GAS ENGINEERS, MANAGERS, &c.

HILL and CO., Gas Engineers and Architects, 11, Appach Road, BRIXTON RISE, S.W., prepare Designs for the construction of New Gas-Works, Bridges, and Roofs, or for the remodelling and extension of existing Works. Also provide Drawings of all kinds of Gas Apparatus and Plant. Drawings, Tracings, and Specifications copied for Engineers and Contractors.

T. NEWBIGGING,
CONSULTING GAS ENGINEER,
5, NORFOLK STREET, MANCHESTER.

A. FAIRLIE WILSON,
CONSULTING GAS ENGINEER,
34, ST. GEORGE'S ROAD, SOUTHWARK, S.E.
Reports and Valuations in the Management, Construction, and Structural Value of Gas-Works.

ALFRED LASS,
SPECIAL ACCOUNTANT FOR GAS COMPANIES,
30, GRACECHURCH STREET, LONDON.

Accounts analyzed and Statistics Prepared for Parliamentary Proceedings, Arbitrations, &c.
The Forms of Account, which have been specially designed by A. L. to meet the requirements of the Gas-Works Clauses Amendment Act, 1871, are now in use by many Gas Companies, and have been universally approved.
The above forms are registered.
Water Companies Accounts also prepared and adjusted.
CONSULTATIONS.

Mr. ROBERT DEMPSTER, Sen.,
CONSULTING GAS ENGINEER,
Of Messrs. Robert Dempster and Sons, Rose Mount Gas Engineering Works,
ELLAND, near HALIFAX,

May be consulted on all matters connected with Valuations, Arbitrations, and Parliamentary Applications connected with Gas-Works. Our R. D., Sen., having been engaged on extensive Arbitration Cases, which, combined with his experience in Construction and Contracting, his knowledge of Engineering and Valuations, is both extensive and reliable.

MOBBERLEY & PERRY,
FIRE CLAY and BRICK WORKS,
STOURBRIDGE.

Proprietors of
BEST GLASS-HOUSE POT and CRUCIBLE CLAY.
Manufacturers for Home and Export.
GAS-RETORTS, GLASS-HOUSE FURNACE,
BLAST-FURNACE, TANK BRICKS, LUMPS, TILES,
And Every Description of Best Fire-Bricks.

NOTICE.
THE GAS & WATER COMPANIES DIRECTORY,
1878.
(WATER SECTION.)

The Editor will feel greatly obliged if Secretaries and Engineers would fill up, and return to him at once, the forms sent them, as the work is now going to press. If any have not received Forms, they will be forwarded immediately, on application to the Editor,

CHARLES W. HASTINGS,
8, BUCKINGHAM STREET, ADELPHI, LONDON, W.C.

F. & C. OSLER,
45, OXFORD STREET, LONDON, W.
MANUFACTORY AND SHOW-ROOMS:
BROAD STREET, BIRMINGHAM.
ESTABLISHED 1807.
MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS
WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.
TABLE GLASS OF ALL KINDS.
CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.

JAMES MILNE & SON,

GAS ENGINEERS,

Gas-Meter, Gas Apparatus, and Gas-Fittings Manufacturers,

EDINBURGH, AND

2, KING EDWARD STREET,

NEWGATE STREET, LONDON.

Meter Works in London—2, CROSS STREET, WILDERNESS ROW, E.C.

STATION-METERS, GOVERNORS, CONSUMERS METERS, GAS LUSTRES, CHANDELIERS, BRACKETS, &c.,

And every description of Gas-Fittings and Gas Apparatus.

J. T. B. PORTER & CO.,

GAS ENGINEERS & MANUFACTURERS,

IRONFOUNDERS AND CONTRACTORS,

GOWTS BRIDGE WORKS,

LINCOLN.

LONDON OFFICES: 1, WESTMINSTER CHAMBERS, S.W.

ESTIMATES FOR GAS-WORKS OF ANY SIZE.

REFERENCES TO 500 WORKS ALREADY ERECTED.

N.B.—All Communications to be addressed to the FIRM ONLY.

GEORGE ANDERSON,

GAS AND CONSULTING ENGINEER,

35A, GREAT GEORGE STREET,

WESTMINSTER, S.W.,

PATENTEE and MANUFACTURER of the following Inventions:—

RETORT SETTINGS—giving great Economy of Fuel.

STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES, WASHERS, SCRUBBERS.

FUEL-MACHINE, for Compressing Breeze and Tar.

N.B.—Pamphlet, with Eighteen Illustrations and Letterpress on the Construction of Gas-Works, post free, 2s. 6d.

PRICES AND ALL PARTICULARS TO BE HAD OF THE PATENTEE,

35a, GREAT GEORGE STREET, WESTMINSTER, S.W.

TO GAS COMPANIES AND THE TRADE.

J. DEFRIES & SONS,

MANUFACTURERS OF

CRYSTAL, BRONZED, & ORMOLU CHANDELIERS, IMPROVED CRYSTAL STAR & SUN LIGHTS VESTIBULE LAMPS, AND THE PATENT CRYSTAL ILLUMINATION.

A LARGE STOCK ALWAYS IN HAND OF

IRON, BRASS, COMPOSITE, AND LEAD TUBES, FOR GAS AND WATER,

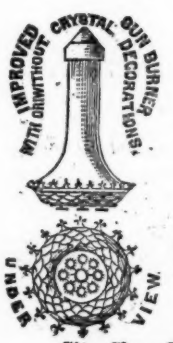
AND EVERY DESCRIPTION OF

GAS AND WATER FITTINGS.

THE PATENT DRY AND WET METER, WITH THE LATEST IMPROVEMENTS.

STREET LAMPS AND COLUMNS IN GREAT VARIETY.

WORKS: LONDON AND BIRMINGHAM.



GAS MOONS, Cut and Engraved, of the newest designs

GAS REFLECTORS In Silver and Glass

GAS NIBS AND **BURNERS** Of every description.

Pattern-Books of Gas-Fittings, Crystal and Ormolu Chandeliers for 1876, are now complete.

City Show-Rooms and Manufactory, 147, HOUNDSDITCH, LONDON.

ESTABLISHED 1830.

CATHELS'S Patent District Dry Gas-GOVERNOR is the only perfect self-acting contrivance for Regulating the Pressures in the higher levels of a district.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, ROTHERHAM.

CATHELS & TERRACE'S Patent Four-WAY DISC GAS-VALVE is the simplest and best Valve for Purifiers, and as a By-pass for other apparatus in Gas-Works. It is always gas-tight, and has no springs, ground faces, or other delicate parts. By its use the flow of the gas cannot be accidentally stopped, and it never sticks.

For prices, &c., apply to the Manufacturers, Messrs. GUEST AND CHRIMES, Foundry and Brass Works, ROTHERHAM.

CATHELS'S Improved Retort-Settings. Guaranteed to heat and wear well, with great economy of Fuel.

Coloured lithograph copies of Working Drawings of Beds of One to Seven Retorts (so clearly arranged and fully shown as to be easily understood by any retort setter or bricklayer) having been made of these valuable settings, they can now be supplied with detailed Specification immediately on receipt of orders.

Apply to Mr. THOS. NEWBIGGING, Consulting Gas Engineer, 5, Norfolk Street, MANCHESTER.

TO GAS COMPANIES.

WE beg to call attention to our IM-PROVED STREET-LAMP REGULATORS with brass cones and burners. Sample, 3s.; carriage paid. Special Steatite Burners for Street-Lamps, 8s. per gross. Quotations for quantities. Street-Lamp Regulators, Wet and Dry Meters repaired.

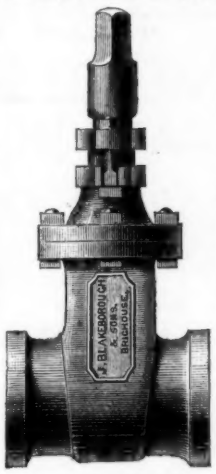
Messrs. TINDALL AND TELLING, Gas Apparatus Works, 74, Wynford Road, Penton Street, LONDON, N.

SLUICE VALVES.

The STRONGEST, CHEAPEST, & BEST in the TRADE.

HYDRANTS.

The Largest Variety of Improved Designs in the Market.



SPECIALITIES.

SLUICE VALVES for Water.
DO. for Gas and Sewage, 1½ to 48 in.
RESERVOIR SLUICES
AIR VALVES.
REFLUX VALVES.
BALL VALVES.
Compound HYDRANTS
Straight-way Do.
Screw-down Do.
Ball Do.
Sluice-Valve Do.
STAND POSTS, various.
STREET WELLS.
STAND PIPES.
PATENT FIRE COCKS
STAND PIPES & JETS.
HOSE UNIONS and REELS.
LEATHER & CANVAS HOSE.
SCREW COCKS and FERRULES.

Tested with 600 to 1000 feet head of pressure.

J. BLAKEBOROUGH & SONS,

COMMERCIAL BRASS AND IRON WORKS, } BRIGHOUSE,
WOODHOUSE IRON WORKS, } YORKSHIRE.

Contractors to the British and Indian Governments.

LONDON OFFICE:
5, WESTMINSTER CHAMBERS, VICTORIA ST., S.W.,
Where Samples may be seen.

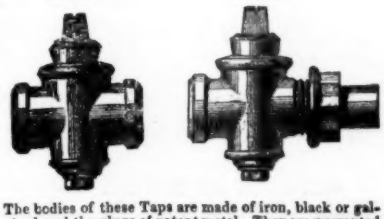
LAMBERT'S

CAST-IRON GAS-MAIN COCKS,

WITH PATENT WHITE METAL PLUGS.

TRADE (L) MARK.

No. 758. No. 759.



The bodies of these Taps are made of iron, black or galvanized, and the plugs of patent metal. They are warranted not to set fast or corrode, as do Iron or Brass Cocks; will always work easily; are strong, well made, durable; of little or no intrinsic value, and therefore not likely to be stolen; and the prices as stated below are (especially upon the larger sizes) fully 50 per cent. less than Brass Cocks.

	½	¾	1	1¼	1½	2-inch.
No. 758, with inside screws for iron pipe, black	2/0	3/0	4/4	6/6	7/6	12/0 each.
No. 759, with union on one end screwed inside for iron pipe, black	2/9	3/10	5/4	8/0	9/0	15/6 each.
Nos. 758 and 759, galvanized	0/3	0/4	0/6	0/8	0/10	1/4 extra.

MANUFACTORY:

SHORT STREET, LAMBETH, LONDON.

THOMAS CARR & SON,
MANUFACTURERS OF
FIRE-BRICKS, LUMPS, TILES, RETORTS, &c.,
SCOTSWOOD FIRE-BRICK WORKS, SCOTSWOOD-ON-TYNE.
Also Makers of all kinds of Common Building Bricks, and of Pressed White and Red Bricks for Facing.

BOUCK & CO., LIMITED,
TAR DISTILLERS & MANUFACTURING CHEMISTS,
MILES PLATTING, MANCHESTER.
BUYERS OF COAL TAR,
And Crude Products therefrom,
AMMONIACAL LIQUOR, &c.

JOHN SPENCER,
VULCAN WORKS, WEST BROMWICH, & 97, CANNON ST., LONDON,
Manufacturer of Every Description of
TUBES & FITTINGS,
Plant, Tools, Stores, and all requisites for Gas and Water Works: Gasholders, Purifiers, Scrubbers, Roofing, Sashes, Retort Fittings, Grids, Socket-Pipes, Lamp-Posts, Wheelbarrows; Brasswork, Chandeliers, and Gas-Fitters Tools; Liquor-Pumps, Valves; Clay Retorts and Fire Goods, &c.

ECONOMY IN THE PRODUCTION OF GAS.
PLUTONIC CEMENT,
For Jointing and Repairing Retorts and Ovens *in* action and *out* of action.
A Pamphlet on the advantages of the above, with modes of Application, References, Prices, &c., free by post, from the Sole Manufacturer,
WILLIAM RICHARDSON, GAS AND HYDRAULIC ENGINEER,
CHARLES HENRY STREET AND BISSELL STREET, BIRMINGHAM.

THE THAMES BANK IRON COMPANY,
(Successors to LYNCH WHITE,)
SUPPLY FROM STOCK
CAST-IRON RETORTS, SOCKET-PIPES for GAS or WATER PURPOSES, FLANGE-PIPES for STEAM, RAIN-WATER PIPES and GUTTERS, HOT-WATER PIPES and BOILERS, and all requisite Connexions for same; also LAMP-COLUMNS, LAMPS, WROUGHT FRAMES, WROUGHT-IRON TUBING, &c., &c.
All kinds of Gas-Works Apparatus and General Castings made to Pattern or Drawing.
ADDRESS—
OLD BARGE WHARF, UPPER GROUND STREET, LONDON, S.E.

THE WIGAN COAL & IRON COMPANY,
LIMITED.
DISTRICT OFFICE: 97, NEW STREET, BIRMINGHAM; AGENT: W. M'GOWAN;
Supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, &c.
N.B.—The Wigan Coal and Iron Company, Limited, are exclusive owners of the well-known HAIGH HALL AND KIRKLESS HALL GAS COAL COLLIERIES.

EDWARD COCKEY & SONS,
GAS ENGINEERS, FROME SELWOOD,
MANUFACTURERS OF ALL DESCRIPTIONS OF
APPARATUS CONNECTED WITH GAS-WORKS.
THE ORIGINAL PATENTEES AND MANUFACTURERS OF THE
DRY-FACED VALVES
FOR PURIFIERS, GASHOLDERS, BYE-PASS, AND OTHER ARRANGEMENTS REQUIRING VALVES IN GAS-WORKS.

The Faced Valves, as made by the Patentees, continue to give great satisfaction, and they are being used extensively by many of the best gas engineers of the day.
They are more easily repaired than any other kind of Valve in use, and can be re-ground in a few hours without removal, and made perfectly gas-tight.
References can be given to many Engineers of high standing, who will testify as to the favour in which they are held.

MANUFACTURERS ALSO OF SUPERIOR WOOD GRIDS FOR PURIFIERS, SCRUBBERS, &c.

WILLEY & COMPANY,
GAS ENGINEERS,
WORKS: COMMERCIAL ROAD, EXETER,
INVITE THE ATTENTION OF GAS COMPANIES AND OTHERS FOR THE SUPPLY OF
EVERY DESCRIPTION OF GAS APPARATUS.

ENGINEERING DEPARTMENT.
NEW GAS-WORKS erected complete. Plans and Estimates furnished. MAINS, METERS, SERVICES, LAMPS, &c., adapted for Towns of any size. Gas Companies advised on Improvements, Extensions, and Alterations of Works.

GASHOLDERS AND TANKS.
RETORTS and RETORT-HOUSE FITTINGS, CONDENSERS, SCRUBBERS, ENGINES and EXHAUSTERS, PURIFIERS, STATION-METERS, GOVERNORS, VALVES, &c.

METER DEPARTMENT.
They beg special attention to the excellence and superiority of their WET and DRY METERS, several thousand being now in use by many of the largest Gas Companies in the West of England and South Wales. Warranted to measure correctly, and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured. A guarantee of Five years tendered with each Meter.

GAS-FITTING DEPARTMENT.
An extensive variety of Choice Designs in CHANDELIERS, PENDANTS, BRACKETS, STAR and SUN LIGHTS, MEDIÆVAL FITTINGS for CHURCHES, &c.
PATTERN-BOOKS and PRICE LISTS furnished.
☞ PLEASE NOTE THE ADDRESS—
GAS ENGINEERING WORKS, COMMERCIAL ROAD, EXETER.

JOHN ABBOT & CO., LIMITED,

MANUFACTURERS OF

IMPROVED

HYDRAULIC CRANES & HOISTS,

Effecting an IMMENSE SAVING in the cost of discharging Coals from Vessels, Barges, &c.

HYDRAULIC RAMS FOR LIFTING AND LOWERING PURIFIER COVERS.

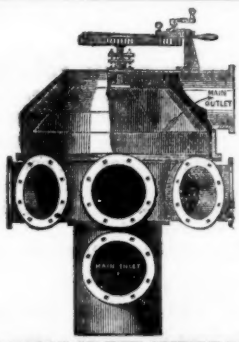
GAS PLANT GENERALLY, PIPES, ROOFING, TANKS, &c.,

PARK WORKS, GATESHEAD.

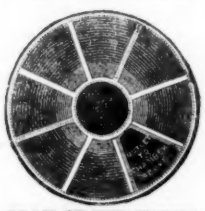
LONDON OFFICES: 2, SUFFOLK LANE, CANNON STREET, E.C.

GLASGOW OFFICES: 54, ST. ENOCH'S SQUARE.

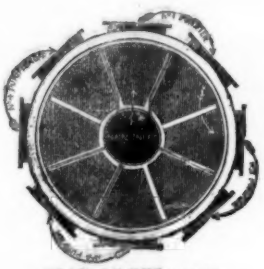
C. & W. WALKERS'
PATENT CENTRE-VALVES.



ELEVATION OF THE CENTRE-VALVE.



PLAN OF THE VALVE.



PLAN OF THE BODY.

These PATENT CENTRE-VALVES are the most perfect and certain means for working Purifiers on the system of three in action, and one out of action. The Valve itself is protected from all injury inside the safety cover. The working of the Valve is so easy, and so governed by the stop-catch movement, that the Purifiers can be instantaneously changed in the dark as well as in daylight. They are scraped perfectly true, metal to metal, the facings heretofore exposed are always covered, and there is nothing more reliable, certain, and durable in a gas-works. By their use the floor of the Purifying-house is clear and level; the Valve and all connexions being beneath the floor, out of the way of working. A considerable improvement and saving is effected in the cost of the connecting-pipes.

MIDLAND IRON-WORKS, DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

THOMAS ALLAN & SONS,

IRONFOUNDERS,

WORKS:

SPRINGBANK FOUNDRY & NORTH WOODSIDE FOUNDRY,

GLASGOW;

BONLEA FOUNDRY, STOCKTON-ON-TEES,

Manufacturers of

CAST-IRON GAS AND WATER PIPES.

SIZES: ¾ to 12 inches at GLASGOW.

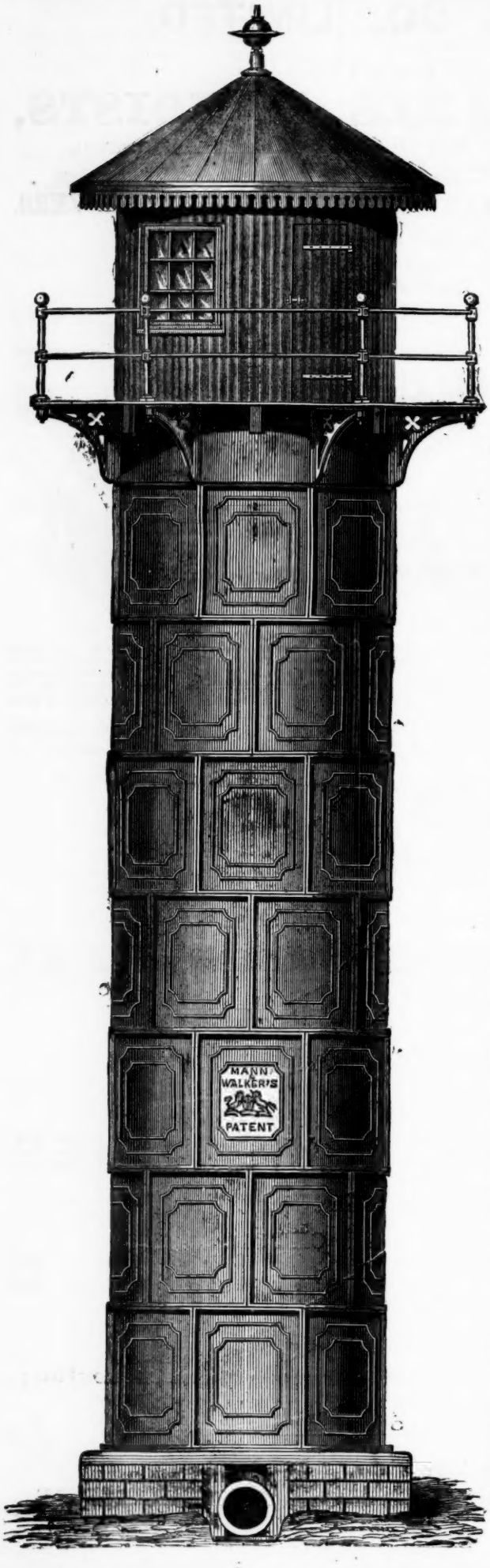
„ 1½ to 10 „ STOCKTON.

A LARGE STOCK KEPT, AND PRICES MODERATE.

Freight to London, in the Stream, 10s. per ton from Stockton; 15s. from Glasgow.

AGENTS FOR LONDON AND THE SOUTH OF ENGLAND:

THE THAMES BANK IRON COMPANY, UPPER GROUND STREET, LONDON, S.E.



C. & W. WALKER,
8, FINSBURY CIRCUS,
LONDON, E.C.

MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the im-portant results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

Fifty million cubic feet of gas per 24 hours are purified from ammonia by these Patent Scrubbers in a winter's day in the gas-works of London, where the purity of gas supply is the highest in the world, under the chemical restrictions of the Board of Trade.

Generally, wherever a high standard of purification is maintained in the chief cities and towns of the British Provinces and of Europe, these Scrubbers have become established.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals, generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

They contain their own engine power, re-quiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

LESMAHAGOW CANNEL COAL.

FERRAND DAVIES,
148, GRESHAM HOUSE, OLD BROAD STREET, LONDON, E.C.,
SOLE AGENT FOR
THOMAS BARR'S LESMAHAGOW MAIN CANNEL.

Quotation and Analysis forwarded on application.

E. & W. H. HALEY,

General Ironfounders and Makers
OF
CAST-IRON GAS AND WATER PIPES.
Sizes 1½ to 15 inches.

LISTER HILLS FOUNDRY, BRADFORD, YORKSHIRE.

GAS PURIFICATION.

BAILES & HALLSWORTH,
CONTRACTORS FOR THE
PURIFICATION OF COAL GAS
BY THEIR
PATENT HYDRATED PEROXIDE OF IRON MATERIAL.

The Material is adapted specially for taking up sulphuretted hydrogen, and will simultaneously absorb any ammonia that may pass the scrubbers.

The spent oxide resulting from our Material is more valuable than that from natural oxide of iron, and manufacturing chemists buy it in preference.

The Material has now been in use during the past three years in most of the principal Gas-Works in Yorkshire and elsewhere.

It contains considerably less moisture than natural oxide of iron, and is much cheaper and more efficient as a purifying agent.

B. & H. are purchasers of Spent Oxide, or will take Spent in exchange for New Material.

FOR SAMPLES AND TERMS, ADDRESS—
BAILES & HALLSWORTH, COPPERAS WORKS, ARMLEY, LEEDS.

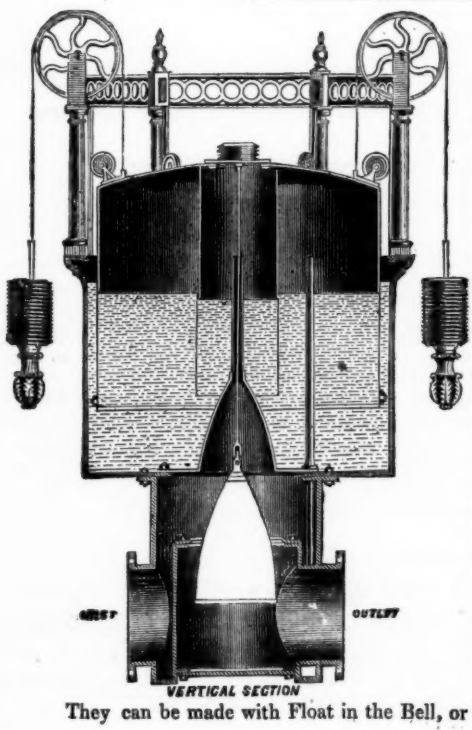
J. & J. BRADDOCK,

GLOBE METER-WORKS,
OLDHAM,

Beg to submit to Gas Engineers their

PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



VERTICAL SECTION

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 24-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,
173, ST. VINCENT STREET, GLASGOW.

SHOTT'S BOGHEAD.

LOTHIAN'S CANNEL
Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

MUIRKIRK, No. 1, CANNEL
Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash.

OLD WEMYSS CANNEL
Yields 13,320 cubic feet of 32·5-candle gas per ton.
Prices and full Analyses on application.

GAS COAL.

POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

SCOTCH CANNEL COALS.

The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

JAMES M'KELVIE,
CANNEL COAL MERCHANT,
HAYMARKET, EDINBURGH.
Established 1840.

WILSON CARTER & PEARSON,

GAS COAL AND CANNEL FACTORS,
Supply to any Railway Station or export Best Wigan Arley Gas Coal and Nuts; best qualities of the Derbyshire, Yorkshire, and North Staffordshire Gas Coals and Nuts; also the best descriptions of Lancashire, Welsh, Scotch, and other Cannel.

Messrs. WILSON CARTER & PEARSON, being contractors to several of the principal Gas Companies in the Midland Counties, have pleasure in being enabled to give them as references.

Chief Offices: Temple Buildings, 50, New Street, Birmingham.
London Offices: 6, Great Winchester St. Buildings, E.C.

HEBBURN MAIN GAS COALS.

T. Stone, Esq., of Weymouth, writes on Nov. 17, 1876: "I have used about 12,000 tons of this Coal, with, I think, the best possible results, although not always under the most favourable circumstances. My Coal account made up to Midsummer last showed a makeage of 10,524 cubic feet per ton of 14½-candle gas, and not a hundredweight of Cannel used. This statement would, I know, be incredible to many men, and may provoke the remark, 'How much of it is paid for?' For the gratification of such, I have to say that, of the above quantity, 9866 cubic feet per ton of Coal carbonized were brought to charge and duly paid for, with the exception of about 6s. per cent. for bad debts. The coke is of excellent quality. The above facts I hold to be a greater recommendation to your Coal than any words of mine could be."

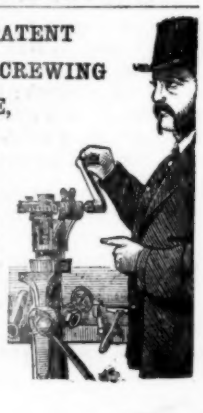
PRICES ON APPLICATION, EITHER F.O.B. OR BY RAIL IN TRUCK LOADS.

THE TYNE COAL COMPANY, LIMITED, OWNERS.
W. RICHARDSON, Fitter,
29, QUAYSIDE, NEWCASTLE-ON-TYNE.

ADDISON POTTER,

WILLINGTON QUAY,
NEAR NEWCASTLE-UPON-TYNE,
Manufacturer of
CLAY RETORTS, FIRE-BRICKS, AND EVERY DESCRIPTION OF FIRE-CLAY GOODS

GRIRDROD'S PATENT
PORTABLE PIPE SCREWING MACHINE,



For 1 in., 1¼ in., 1½ in., and 2 in. Gas Threads, complete £7 10s.

In use at the chief gas-works, and giving great satisfaction.

For other useful goods, see Bailey's "Illustrated Inventions," post free 3s. 6d.; gratis to ledger customers.

W. H. BAILEY & CO.,
Brassfounders, Gauge Injector and Tool Makers,
ALBION WORKS, SALFORD,
LANCASHIRE.

Established

1795.

JOSEPH CLIFF & SONS,

THE ORIGINAL

WORTLEY FIRE-BRICK WORKS,

NEAR LEEDS,

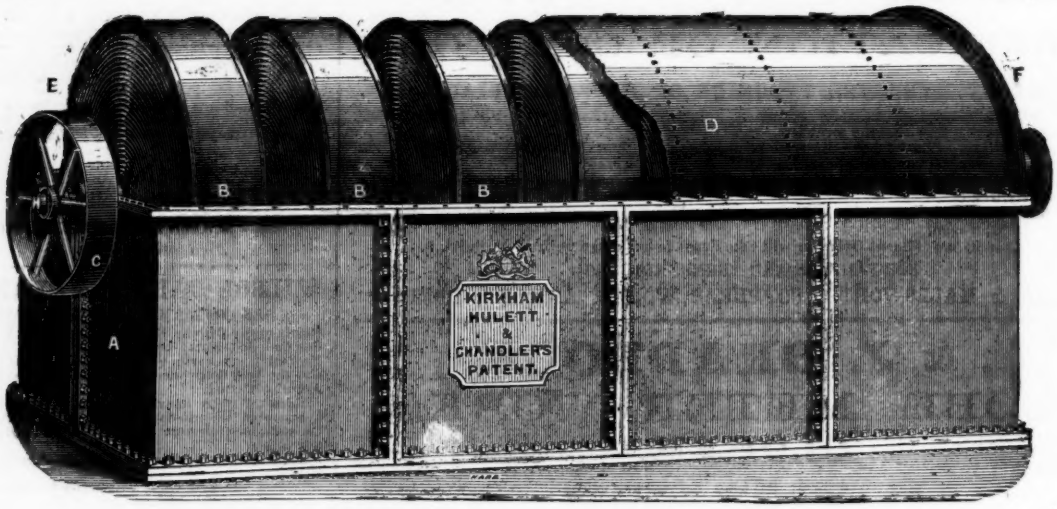
London Wharf: No. 4, inside Great Northern Goods Station, King's Cross, N.;

LIVERPOOL: Back Leeds Street.

SPECIAL NOTICE.—Our Patent Machine-made Retorts have now been in *actual work* nearly 1000 days, and are yet in good order. References on application.

July 2, 1877.

STANDARD WASHER AND SCRUBBER.



The advantages of the Apparatus will doubtless be understood by those interested in gas manufacture.

The principal points of any Apparatus for the extraction of ammonia may be summarily stated as follows:—

1. **A large amount of Surface is desirable.**
2. **Such Surface should be always effectually Wetted.**
3. **The Surfaces or Scrubbing Material should cause no Pressure.**
4. **The Gas should meet various strength Liquors on its course.**
5. **However small the quantity of Water used, it ought to operate over the whole Surface.**
6. **Changing Scrubbing Material is both Objectionable and Expensive.**
7. **Economy both as to Space occupied and Cost of Apparatus is an important item.**

All these requisitions are supplied by the above Apparatus, of which the following is an explanation:—

A is a cast-iron tank, formed into several separate water-tight compartments.

B B B volutes of sheet iron fitted to the centre shaft, which is driven by the pulley, C, and causing the said volutes to revolve each in a separate compartment filled with water or other fluid.

D, the cover, has partitions fitted into it corresponding with those in the tank, sufficient space being left between the top of the partition in the tank and the lower edge of that in the cover, to allow the gas a free passage through the first volute to the second, and so on to the third, fourth, &c.

The action is as follows:—The crude gas entering at E is partly washed in the first compartment, which becomes 10 or 12 oz. liquor, or stronger if required, according to the quantity allowed to enter per ton; the gas then passes to the second, where the liquor is of a less strength; thence into a weaker liquor, as it passes from one compartment to the other, finishing at the last compartment or outlet, F, with clean water, which is constantly flowing and running over from one compartment to another, until it reaches the last space, from which it flows from the outlet-pipe into the well or tank ready for sale or removal.

Taps are inserted in each compartment for the convenience of drawing liquor for testing, &c.

Applications as to Cost, &c., may be obtained of either

Mr. D. HULETT, 55 & 56, HIGH HOLBORN;

Messrs. KIRKHAM & HERSEY, GAS ENGINEERS, 21, ABINGDON STREET, WESTMINSTER;

Or Messrs. CHANDLER, 104, NEWINGTON CAUSEWAY.

Inquirers will please state their Maximum Day Make.

THE SILKSTONE & DODWORTH COAL & IRON COMPANY, LIMITED,

DODWORTH, BARNSLEY.

BENJAMIN WHITWORTH, Esq., M.P. . . . . Chairman.
Mr. RICHARD HARTLEY . . . . . Managing Director.

REAL OLD SILKSTONE GAS COAL.

JAMES PATERSON, Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—

"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces **12,240** cubic feet of 16·66 candle gas."

The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

PRICES QUOTED TO ANY RAILWAY STATION, OR F.O.B. HULL, GRIMSBY, GOOLE, KEADBY, LIVERPOOL, AND FLEETWOOD.

GAS PURIFICATION & CHEMICAL Co., LIMITED,

(Successors to JOHN WILLIAM O'NEILL & CO.,)

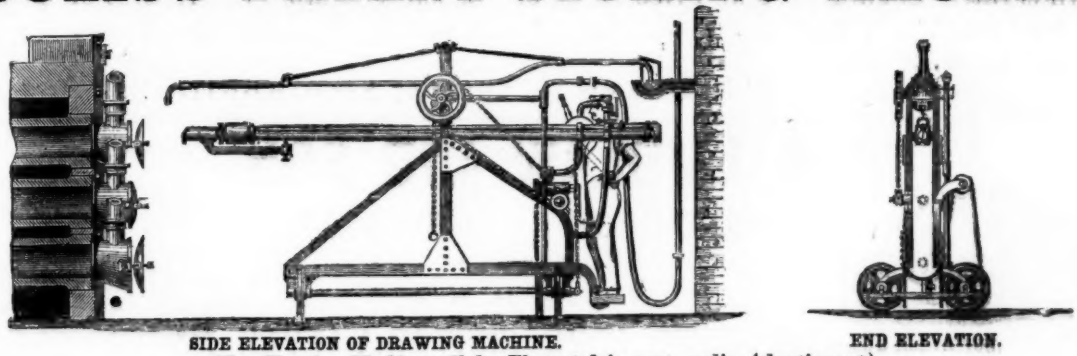
Offices—PALMERSTON BUILDINGS, OLD BROAD STREET, LONDON, E.C.,

CONTRACTORS FOR GAS PURIFICATION BY OXIDE OF IRON.

The superiority of the material supplied by this Company is generally recognized, and it is now in use in nearly all the London and most of the large Provincial Gas-Works.

JOHN WILLIAM O'NEILL, SAMUEL H. JOHNSON, } Joint Managing Directors.

FOULIS'S PATENT STOKING MACHINE.



SIDE ELEVATION OF DRAWING MACHINE. END ELEVATION.

(The Charging Machine will be Illustrated in next week's Advertisement.)

Makers: TANGYE BROTHERS and HOLMAN, London and Birmingham; ADAM WOODWARD and SON, Manchester; ROBERT LAIDLAW and SON, Glasgow; MASCHINENBAU-ACTIEN-GESELLSCHAFT HUMBOLDT, Kalk bei Deutz;
Or all particulars may be had from JAMES WOTHERSPOON, 31, St. Vincent Place, Glasgow.

NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS AND COLLIERIES,

NEAR SHEFFIELD.

CELEBRATED SILKSTONE GAS COALS.

The various descriptions of Gas Coal produced from the above Collieries possess an unequalled reputation, combining in a large degree the constituents essential for the production of the best quality of Coke and Gas of a high illuminating power.

A recent extensive development of the Collieries enables us to offer increased supplies.

JAS. PATERSON, Esq., of Warrington, after testing various qualities of our Coal, has sent the following testimony of their merits:—

"Warrington Gaslight and Coke Company,
Offices, Mersey Street, Warrington, April 23, 1877.

"MESSRS. NEWTON, CHAMBERS, AND CO.,

"GENTLEMEN,—After carefully testing the various samples of Gas Coals sent from your Collieries for analysis, I have pleasure in reporting them as belonging to the highest class of Gas and Coking Coals.

"The average of Nine samples gives a yield of **12,500** cubic feet of **15½**-Candle Gas, being equivalent to **664** lbs. of sperm per ton, and **1420** lbs. of fixed carbon of a very superior quality. All the samples bear a close relation to each other in value.

"Yours truly, "JAMES PATERSON."

Full particulars will be sent on application to us—address as above.

NEW PATENT WET GAS-METER,

THE "RELIANCE,"

MANUFACTURED BY THE

GAS-METER COMPANY, LIMITED,

238, KINGSLAND ROAD, LONDON; UNION STREET, OLDHAM; HANOVER STREET, DUBLIN.

The object attained by this invention is the *correct measurement of Gas under every fluctuation of the pressure.*

Accuracy is obtained by subjecting the whole of the water which determines the measuring chambers of the drum to one uniform even pressure, and so prevents unequal displacements of the water-line.

The "RELIANCE" METER has been tested by several of the most experienced official meter inspectors. Copies of their reports may be obtained on application to the

GAS-METER COMPANY, LIMITED,

238, KINGSLAND ROAD, LONDON.

TO DIRECTORS OF GAS COMPANIES, GAS ENGINEERS, AND MANAGERS OF GAS-WORKS.

GENTLEMEN,—We beg to remind you that this is the time when all orders of any magnitude for Fire-Clay Gas-Retorts, and all kinds of Fire-Clay Goods likely to be required during next season, should be given out.

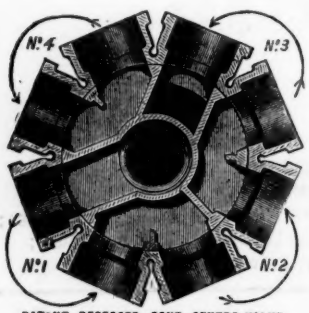
In reply to some scandalous reports that have been raised respecting our firm, we take this opportunity of saying that we have been established as the largest makers in the trade for over thirty years; that we are now in a better position than ever to supply our customers; and that, for quality of material, workmanship, and endurance, our goods are equal or superior to any produced.

Soliciting your favours, we are, Gentlemen, your obedient Servants,

HARRIS AND PEARSON.

Illustrated Catalogues and Price Lists, or Special Quotation (on receipt of specification), sent free to any part of the World. Also quotations for Cast-Iron Pipes, Wrought-Iron and Lead Tubing.

ADDRESS—HARRIS AND PEARSON, STOURBRIDGE.



PATENT RECESSED CONE CENTRE-VALVE.
Sectional Plan.

R. LAIDLAW AND SON,

EDINBURGH AND GLASGOW,

SOLE MAKERS OF

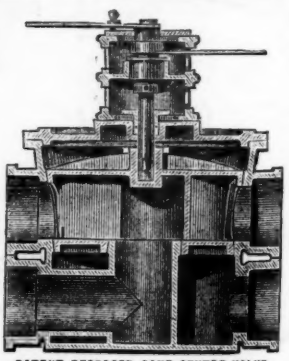
PATENT

RECESSED CONE CENTRE-VALVES,

Constructed on the principle of the ordinary Plug-Cock.

THROUGH-WAY & FOUR-WAY COCKS

Of all descriptions.



PATENT RECESSED CONE CENTRE-VALVE.
Sectional Elevation.

LONDON OFFICE: 106, CANNON STREET.

D. HULETT & CO.

Invite the attention of Gas Companies, Corporations, and others to their

PATENT STREET LAMPS,

Which are so constructed that neither putty nor other materials are required to secure the glass. No hacking out of old putty, which frequently destroys the frames. A new pane of glass can be inserted in two or three minutes by any inexperienced person, the glass being secured by a hinged flap and turn button.

PRICE 10s. each, net. Special quotations for large quantities.
Also made EXTRA STOUT recommended for its durability, PRICE 11s. 6d. each.

D. HULETT'S IMPROVED SERVICE CLEANSER,

By the use of which stoppages in service and other pipes are freed from naphthaline and other obstructions in a few minutes. PRICE 73s. net.

HULETT'S PATENT MERCURIAL REGULATOR,

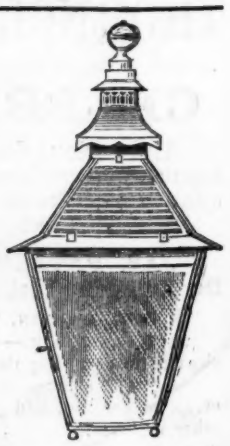
For inserting in mains, to prevent the excess of pressure in high ground, or other elevated positions.

PATENTEES OF IMPROVED WET AND DRY GAS-METERS.

Makers of all kinds of Pressure-Gauges, Gaseliers, and every kind of Gas-Fittings for the Trade.

GAS HEATING AND COOKING STOVES.

55 and 56, HIGH HOLBORN, LONDON.



London: Printed by WILLIAM BOUGHTON KING (at the office of Clayton and Co. 17, Bouverie Street, Fleet Street); and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Dec. 18, 1877.